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Contents for December 31, 1929

VOLUME 70, NUMBER 27

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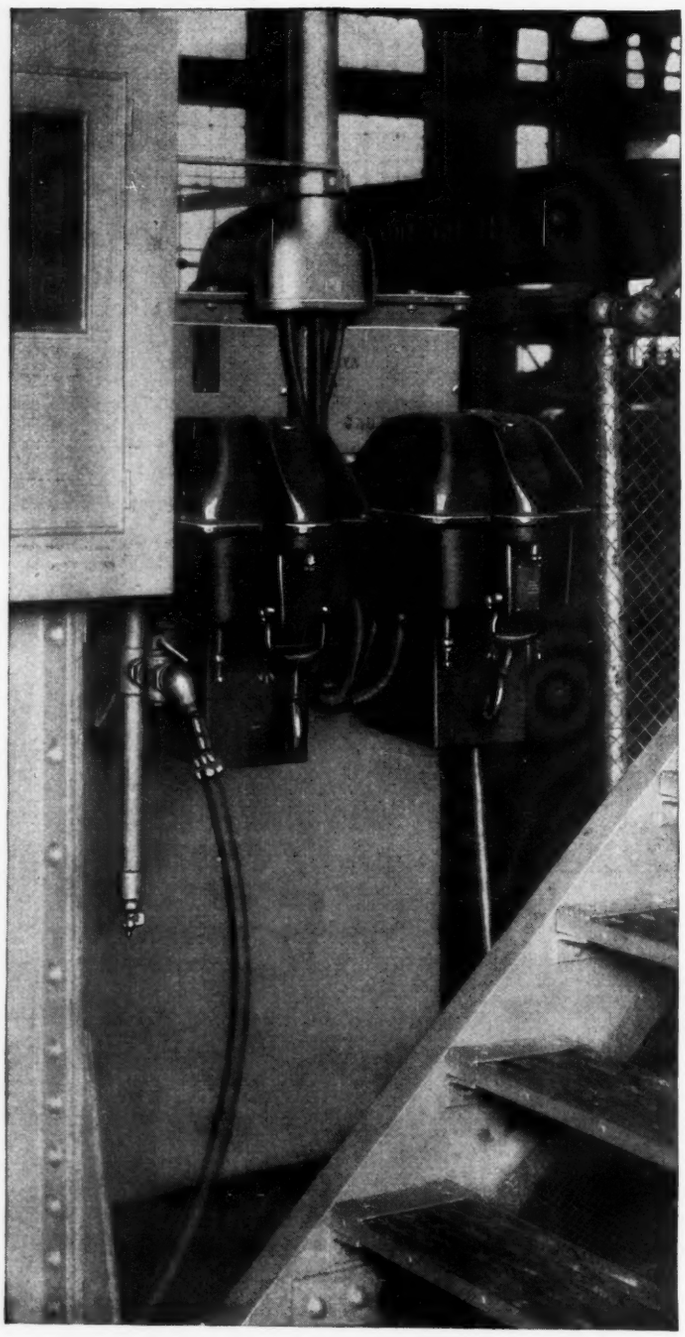
Increase Distribution *and* Improve *Power* *by this* EASY



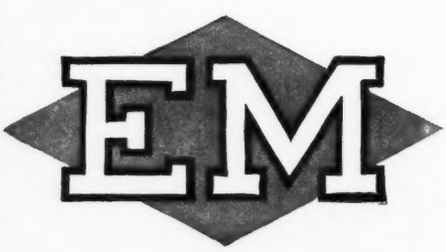
105 kv-a, 220 volt E-M Capacitor at Cincinnati Grinders Incorporated. This capacitor is divided into two sections of 70 and 35 kv-a respectively. This makes possible the adjustment of corrective kv-a as requirements vary during the day. Both this and the Capacitor shown on the opposite page may be operated at one-third, two-thirds or full capacity as desired; the amount of correction and service being determined by the number of machines in operation at a given time.

INDUSTRY recognizes in the capacitor a stabilizer of electrical distribution conditions. Because it calls for no change in existing equipment, it is not only expedient but economical.

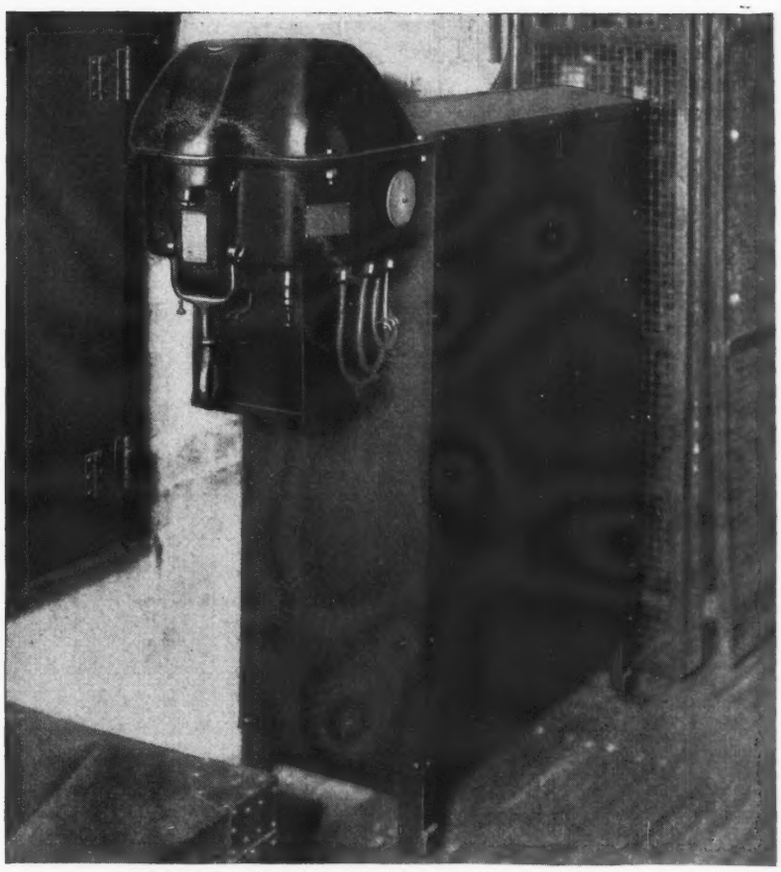
In plants where induction motors are necessary for machine drives, their inherent disadvantage of low power factor is easily and economically corrected by E-M Capacitors. Voltage is brought back to normal; heating of motors and transformers is eliminated; more capacity for additional motors is often made available; power bills usually show very worthwhile savings.

A quite typical instance is the case of Cincinnati Grinders Incorporated of Cincinnati, Ohio. This company purchased electric power. It operated machine tools driven by small induction motors which were under-loaded much of the time. This condition produced a power factor of .33 which resulted in overloaded distribution circuits and transformers.

Then came the day when it became necessary to add more plant equipment—more machine tools. Additional capacity in lines and transformers was needed for the new



Capacity *Factor* MEANS



E-M Cell-type, 30 kv-a, 440 volt Capacitor. An advanced type—compact and highly efficient.

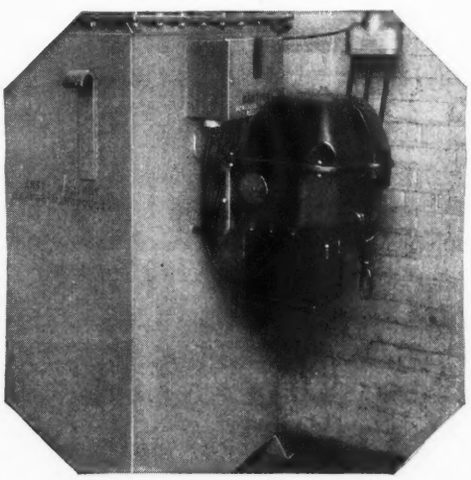
motor installations.

There were two ways out of the problem.

Larger transformers could be installed and distribution lines reinforced to bring capacity up to requirements and allow for some future extension. While this cost would be moderate, there would still remain the disadvantage of power factor as low as ever—with the possibility that the power company eventually would impose a penalty for the condition.

So Cincinnati Grinders Incorporated installed E-M Capacitors on the distribution lines. Results were immediate and gratifying.

Power factor went up from .33 to between .90 and .99. An estimated gain of 5 per cent in efficiency of the transmission of power from the sub-station resulted. The 640 amperes which, approximately, was the current to the plant at the old power factor of .33 for a plant load of 110 Kw., was reduced to 260 amperes. Voltage was improved from 218 to 236 volts. The three 50 kv-a transformers furnishing the power of the plant are now available for additional load.



45 kv-a, 220 volt E-M Capacitor at Cincinnati Grinders Incorporated—the smallest of the three.

This typical result is indicative of the possibilities in E-M Capacitors. Learn about them . . . how they may help solve your own problems of electrical distribution and consumption. A copy of the 48-page book "Reducing the Cost of Electric Power" will be sent on request.

Electric Machinery Mfg. Company

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CAPACITORS

for reducing electric power cost and improving plant electrical conditions

Left: Sectional view, Fig. 651, Jenkins Standard Iron Body Gate Valve, flanged, with outside screw and yoke and rising spindle. Above: Typical installation in circulating and house pump lines, F. W. Woolworth & Co., Chicago.

Woolworth's, too, want *their* money's worth

F. W. Woolworth & Co., have built a nation-wide business on the policy of giving the buyer his money's worth. But Woolworth's, too, want their money's worth. So when valves were needed for a new Chicago store, Jenkins were selected.

Full measure of valve value is built into every Jenkins. In the sectional view of the Fig. 651, Jenkins Standard Iron Body Gate Valve, shown, observe how perfectly the body metal is distributed by correct design. The refinements that characterize this valve, of the outside screw and yoke and the rising spindle type, are to be found in every Jenkins. Spindles are of manganese bronze with heavy, clean cut threads. Body metal is a high-test iron to Jenkins own specifications.

Long, efficient valve life and lasting valve economy are the rule with Jenkins. Put in a Jenkins wherever there is a job for a valve. Made in bronze and iron, in standard, medium and extra heavy patterns, Jenkins are obtainable through supply houses everywhere.

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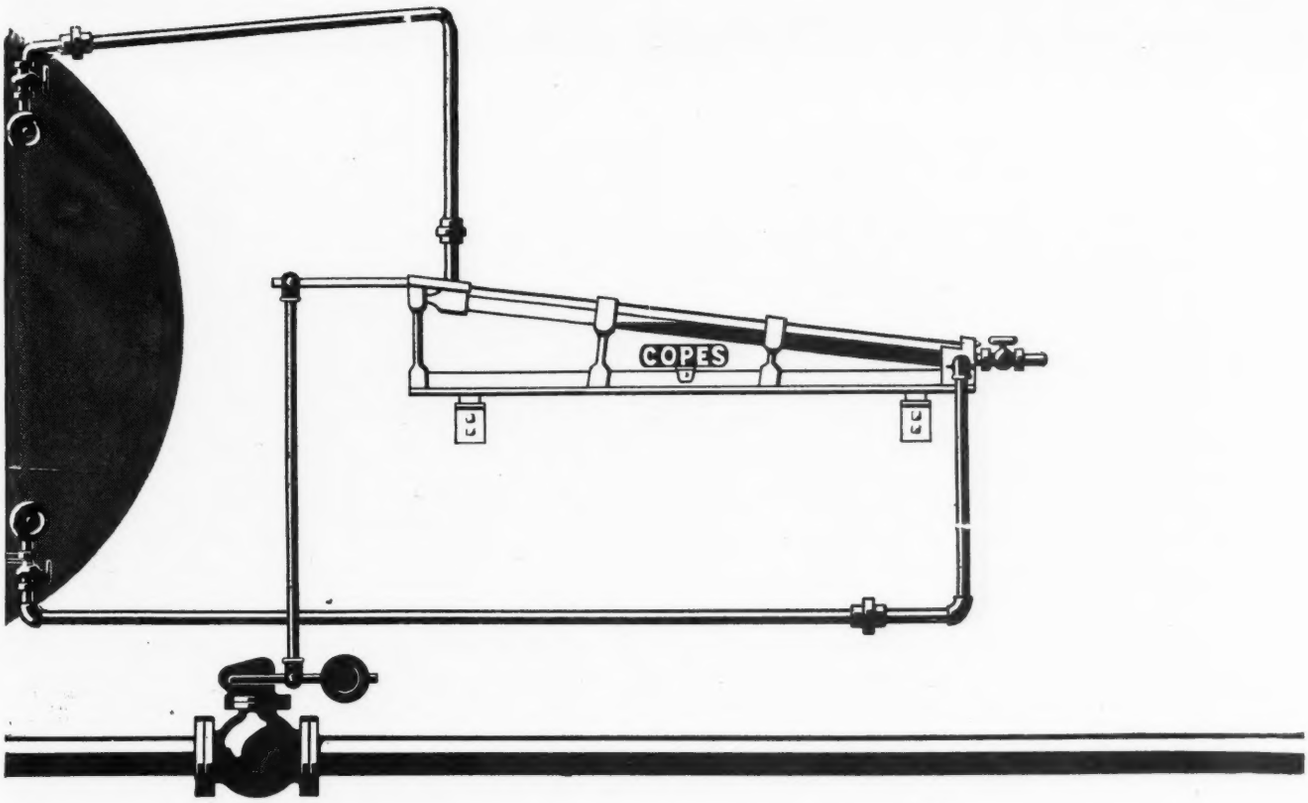

NATURALLY THE LEADER

There must be some reason why three COPES Regulators are purchased today to each one of all other makes combined. The fact that there are now over 28,000 COPES in service throughout the world cannot be lightly dismissed.

And one of the qualities which has built this overwhelming COPES preference is the extraordinary long life of the regulator. This long life is not mere accident. It is the natural result of superior design, plus quality of construction found in no other feed water regulator—***regardless of price.***

Consider, for instance, the simplicity of COPES operation . . . its utilization of the natural forces of expansion and contraction, and gravity. Consider the sturdiness of each piece of COPES Equipment . . . each far more rugged than the ordinary.

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COPES

SYSTEM OF BOILER FEED CONTROL

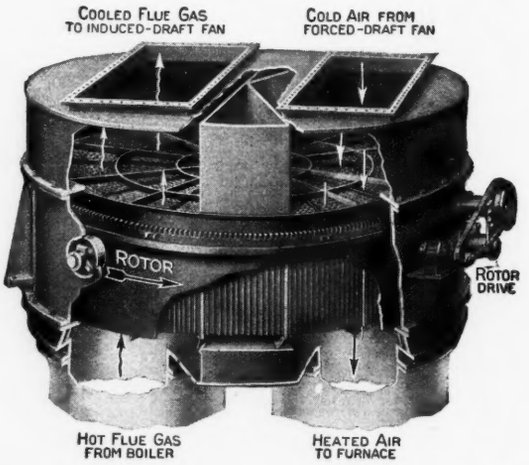
LJUNGSTRÖM-EQUIPPED

—the finest paper mill erected in 1928

THE new $2,200,000 120-ton sulphate pulp mill built by Union Bag & Paper Power Corporation at Tacoma, Washington, was the outstanding development in the wrapping paper industry in 1928.

Everything possible has been done to make this mill highly efficient and the leader in its field. The buildings are of the highest type of steel, brick and concrete construction, and transportation facilities include trackage connecting with five railroads, and terminals for ocean steamships. As power is the biggest factor in paper pulp production, particular care was exercised in selection of all boiler-room equipment.

The choice of the Ljungström Air Preheater as the one best able to recover the practical maximum of waste heat from the flue gas and to pay the highest net money return through utilization of the recovery to preheat the combustion air, is therefore an exceptionally significant tribute to Ljungström efficiency and economy.



Type CANX for use with inedependent forced-draft and induced-draft fans. Operated with rack-and-pinion drive, and has a center thrust bearing in the cold air side of the top housing. For boiler units of 1000 hp. and over.

The two Ljungström Preheaters here are connected to two 800-hp. twin-drum water-tube boilers which burn either wood refuse or oil and are normally operated at between 225 and 250 per cent of rating.

Flue gas entering the preheaters at 585 to 620 deg. Fahr., is reduced to between 295 and 320 deg. in preheating the combustion air to between 385 and 400 deg. The Ljungström Air Preheaters are of the independent-fan type, and the flue gas inlet ducts are dampered to permit perfect draft balance under any operating conditions.

The designers of large high-pressure industrial plants to use power 10 or more hours per day have come to realize that forcing at high rates to meet the requirements of heavy load periods is entirely practical and without serious economy sacrifice where preheated combustion air is correctly utilized—and that the installation of the Ljungström Preheater, for this purpose, makes lower fixed and operating charges than installing more boilers to get the same capacity increase. Users of such installations also know that the Ljungström Air Preheater also effects big fuel savings (8 to 14 per cent) under *all* operating conditions and pays a highly profitable net return *every hour* of the operating day.

The recent radical improvements, and size and cost reductions of Ljungström Preheaters of all types and sizes for given delivery capacity now make the benefits from Ljungström 70 per cent recovery greater in *any* plant, and now highly profitable in plants where heretofore such recovery and utilization did not pay sufficient return to justify the added installation and maintenance costs.

Ask us to submit figures with guarantees or at least write for our new Ljungström Catalog.

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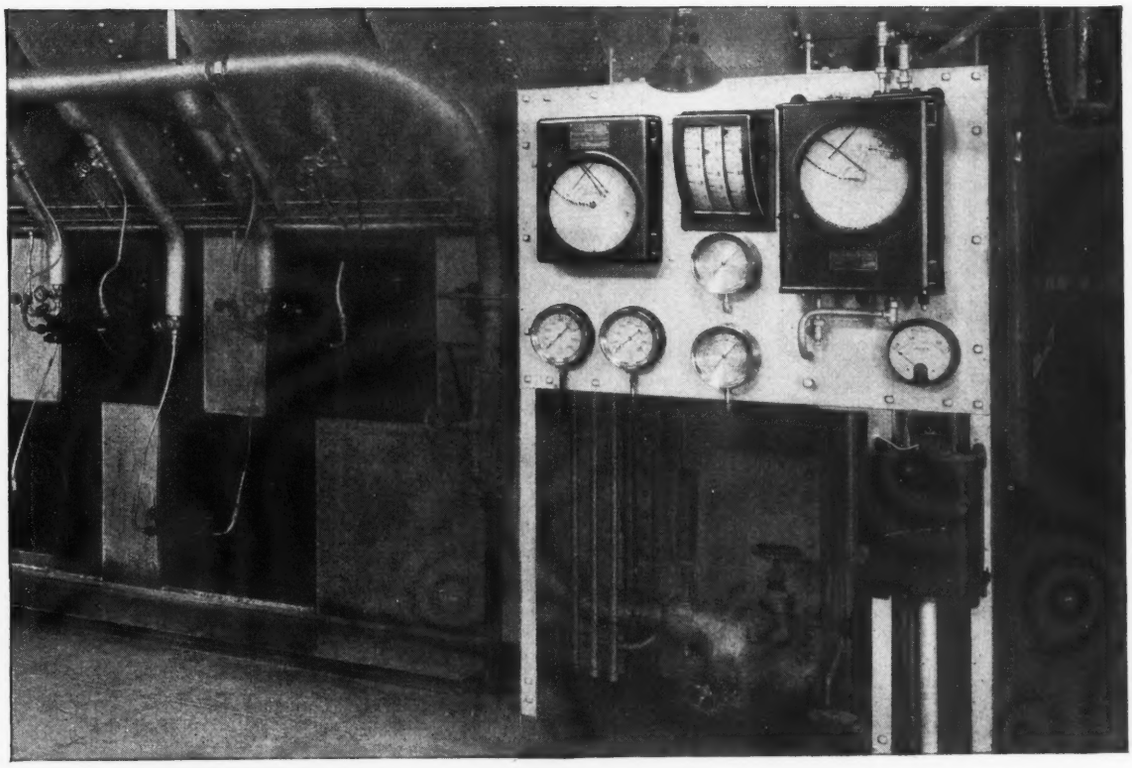


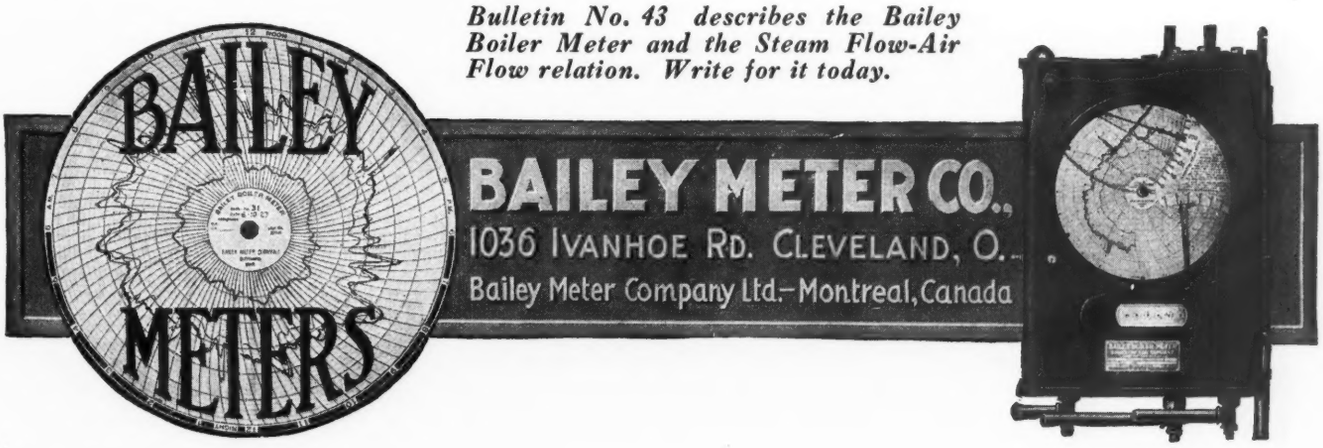
The Fireman of Today Turns Waste into Power

The fireman of today is no longer the shoveling, slice bar wielding boiler house slave of yesterday.

In progressive plants Brawn has been replaced by Brains, Power is the slave and instead of blind operation with its costly losses, Efficiency and Economy are secured by the use of Bailey Boiler Meters.

The modern Fireman operates his boilers from the Steam Flow—Air Flow relation as shown by the Bailey Boiler Meter. This method enables him to continually visualize the ever changing combustion conditions. By it he spots losses as soon as they occur and turns waste into useful power.

Bulletin No. 43 describes the Bailey Boiler Meter and the Steam Flow-Air Flow relation. Write for it today.



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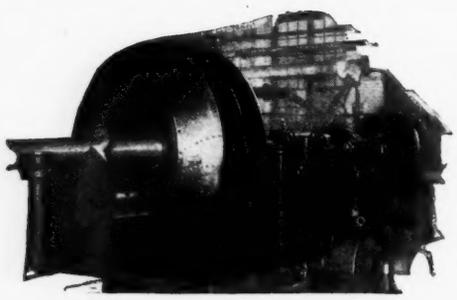
WHEN a fan has to travel at four miles a minute or more with about two thousand horse power behind it... well, it *has* to stand up! We are building these kinds of fans . . . and we can't afford to take chances... we hand-rivet every joint as painstakingly as the finest craftsmen can do it. Welding is *not* used on Turbovane wheels! This method of assembly and the fact that we make the most exacting selection of alloy steels, together with the most modern methods of heat treatment acquired by years of experience, is an *assurance* of *reliability* for Sturtevant Turbovane Fans. It would be a pleasure to send you a Turbovane Catalog. The nearest Sturtevant Branch Office will gladly mail it on request.



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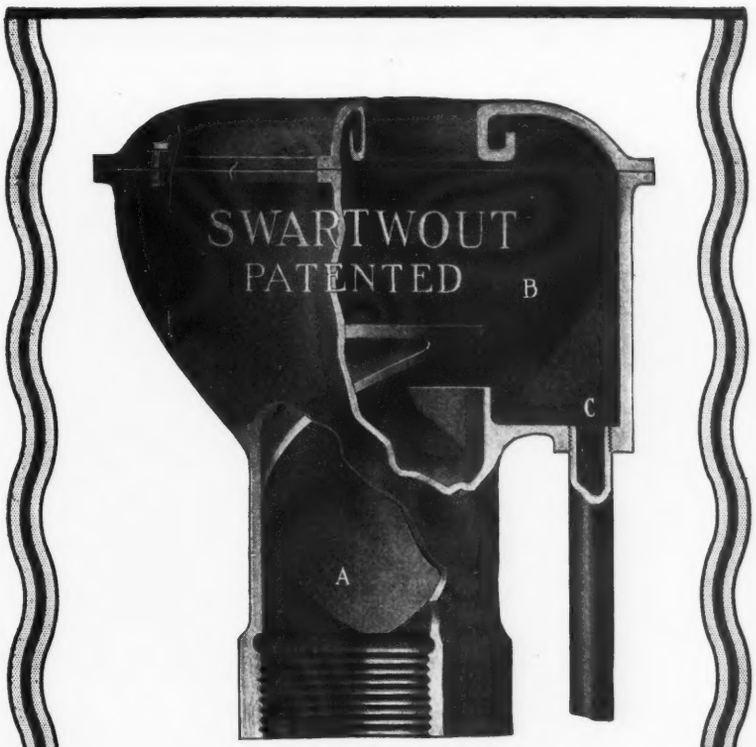

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Yes . . . an exhaust head without baffle plates

Your objection to roaring exhaust heads that create annoying back pressure is fully justified, but you will have no such complaint to make against the Swartwout Cast Iron Exhaust Head which has no baffle plates, the usual source of all trouble.

Yes, an exhaust head without baffle plates . . . one that thoroughly removes water and oil from exhaust steam without using the age-old jolting method. Instead, the Swartwout Exhaust Head employs centrifugal force as its operating principle. In the neck of the head is a helix. Steam is whirled dry and exhausted. Water and oil are drained off by a pipe connection.

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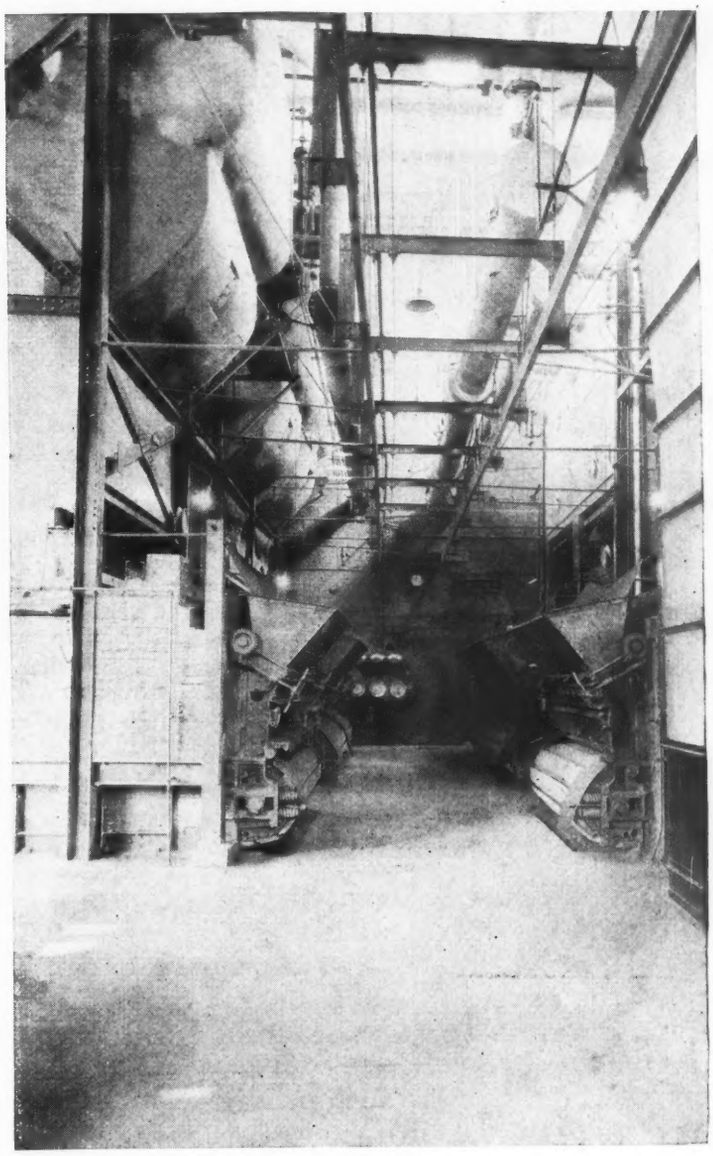

85%

overall efficiency with No. 3 buckwheat coal at 300% boiler rating with Badenhausen High-Efficiency Steam Generating Units

This is the record of three Badenhausen Steam Generating Units installed five years ago by the Kieckhefer Container Company, Delair, N. J.

Certain predetermined results were the governing factors in the selection of these units. Confidence in these guaranteed results had been built up through the efficient operation of Badenhausen units which had been serving them for some years past.

Because the Badenhausen Steam Generating Unit, consisting of boiler, superheater, water cooled walls, and water preheater, is so designed that positive, unrestricted circulation is maintained throughout the unit, high steam production and liberation is possible per square foot of heating surface. A minimum amount of heat is lost up the stack. And with Badenhausen-Carl Steel Clad Insulated Setting, a minimum amount of heat is lost through radiation. Result—HIGH EFFICIENCY *AT* HIGH CAPACITY.

The Badenhausen-Rohrer air heater not only furnishes preheated air for combustion, but also supplies heated air for process work.

May we help you solve your problems of steam generation?

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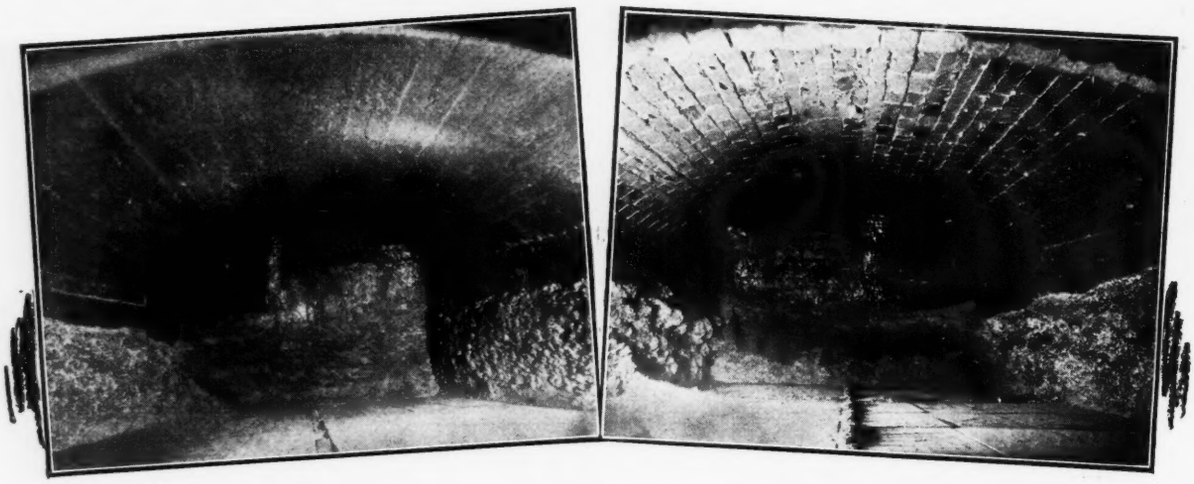
QUIK-PACH IS SUPERIOR



The photographs above are of twin furnaces under a 300 horse power B & W Boiler, operating continuously at 215 to 220% of rating in the plant of the largest operator in the anthracite district.

The entire lining at the left is built of QUIK-PACH, except the left wall which is lined with high-grade fire brick. The lining at the right is built entirely of a well-known brand of high-grade fire brick. ...Examine the illustrations carefully—both linings had exactly the same service. Note the amount of clinker and ash adhering to the brick lining as compared with the QUIK-PACH lining. The one-piece QUIK-PACH lining, having no joints into which the clinker and molten slag can penetrate, withstands damaging actions and lasts longer—definite proof that QUIK-PACH is superior!

Use QUIK-PACH for complete one-piece furnace linings or for quick easy repairs to burnt-out or fallen sections. It comes to you in soft, easy-working, putty-like form. Any man around the plant with a mallet and a few simple tools can do the job. Try it and you will understand why it is the greatest boiler-room "first aid".

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Engineers and operating men have learned through practical contacts that Link-Belt equipment, whether for conveying, screening, or power transmitting purposes, is built to high practical ideals, and with the purpose of giving the customer a little more than he expects. "Built by Link-Belt" also symbolizes an ambition to improve and to better Link-Belt products year by year, and to maintain a Company policy devoted to the interests of their clients.

The natural result of such an attitude has been to produce a line of dependable equipment, and to expand engineering and manufacturing facilities to meet the growing demands of users who buy on the basis of performance.

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LINK-BELT

IN THE new-type Stowe Stoker the best features of underfeed, overfeed, chain grate and inclined stokers are combined to produce outstandingly efficient combustion.

A compact fuel bed—so necessary for high CO_2—is set up on the first half of the grate. Then multiple retarding influences slow up the fuel-bed speed over the last half of the stoker—compensating for coal burned away and insuring this thick and closely massed fire over the *entire grate area.*

This slowed-up travel of the fuel-bed is purely automatic in the Stowe and varies with different fuels. That's one of the reasons why the Stowe can handle so successfully a wide variety of coals—ranging from high-grade, high B.T.U. coals to those with B.T.U. below 10,000.

In fact, Stowe Stokers have no local restrictions. Many of them are now giving efficient service with coals from Pennsylvania and Virginia, the Central and Southern States and as far west as Iowa, Missouri and Kansas.

Let us send you further data concerning this economical and efficient combustion system. Send the coupon today.

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City ..... State .....

P-12-3-29

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Compensated Feed

You can't afford to disregard basic principles

Lopulco unit mill with integral classifier. The door to the grinding chamber has been removed to show the ready accessibility for inspection of the hammers and for replacement, when necessary.

In pulverized fuel firing, uniform fineness is required for uniform furnace conditions.

There is a definite relationship between the fineness of the coal particles and furnace efficiency.

This relationship is not a hobby, an opinion, or a sales argument—it's a proven fact.

Up goes the size of the coal particles.

Down goes the furnace efficiency.

The primary function of a pulverizing mill is to deliver the required quantity of coal of proper fineness at all ratings — regardless of the life of the mill or the wear on the hammers.

The overall performance depends on the inherent correctness of overall design.

The Lopulco air swept classifier is a positive assurance of properly sized coal as only the finer particles CAN leave the classifier—the coarser coal is automatically returned to the mill for further grinding. Each particle must meet the standard of fineness for which the system is set. This classification is simple, positive and automatic and is independent of the wear on the hammers. Incidentally, the Lopulco classifier is a patented feature and is available only on Lopulco pulverizers.

The name on a particular mill may have little significance. However, the name plate on the Lopulco unit mill reflects an experience of over 45 years in designing, developing and manufacturing pulverizing equipment — nearly a half century of acknowledged leadership.

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How *do you figure* the cost of Lubrication?

THE cost of the lubricants, of course, is part of the cost of lubrication. And in all too many cases—there the matter ends. But the man who is thinking ahead is beginning to realize more than ever before that there's far more to lubrication than the price he pays for oil and grease.

Maintenance and repair costs due to incorrect lubricants or inefficient application, idle plant equipment chargeable to excessive wear, power losses and excessive oil consumption are the really important things to consider.

Lubrication is decidedly a matter for engineering and executive attention. Call The Texas Company first. Ask to have a Texaco Lubrication Engineer go over the plant with you. He is a specialist in his field, knows what is required; knows the effective lubricant for any given condition and how to apply it. This service is at your call free of all cost or obligation. Effective lubrication may mean thousands of dollars saved annually.

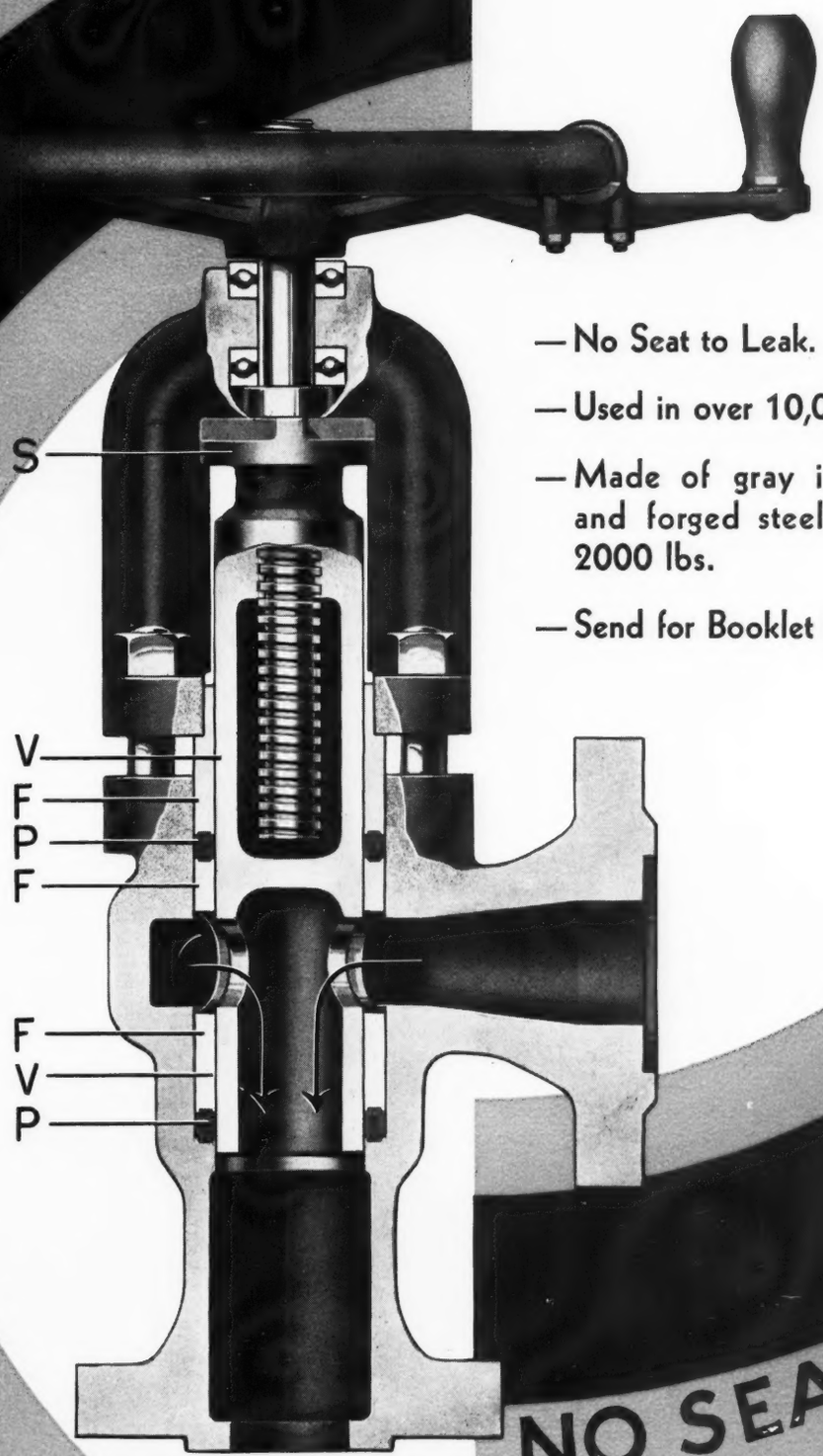
TEXACO LUBRICANTS

There is a Texaco Lubricant for every purpose

THE TEXAS COMPANY
17 Battery Place, New York City
Offices in Principal Cities

YARWAY

BLOW-OFF VALVES



— No Seat to Leak.

— Used in over 10,000 plants.

— Made of gray iron, electric furnace and forged steel for all pressures to 2000 lbs.

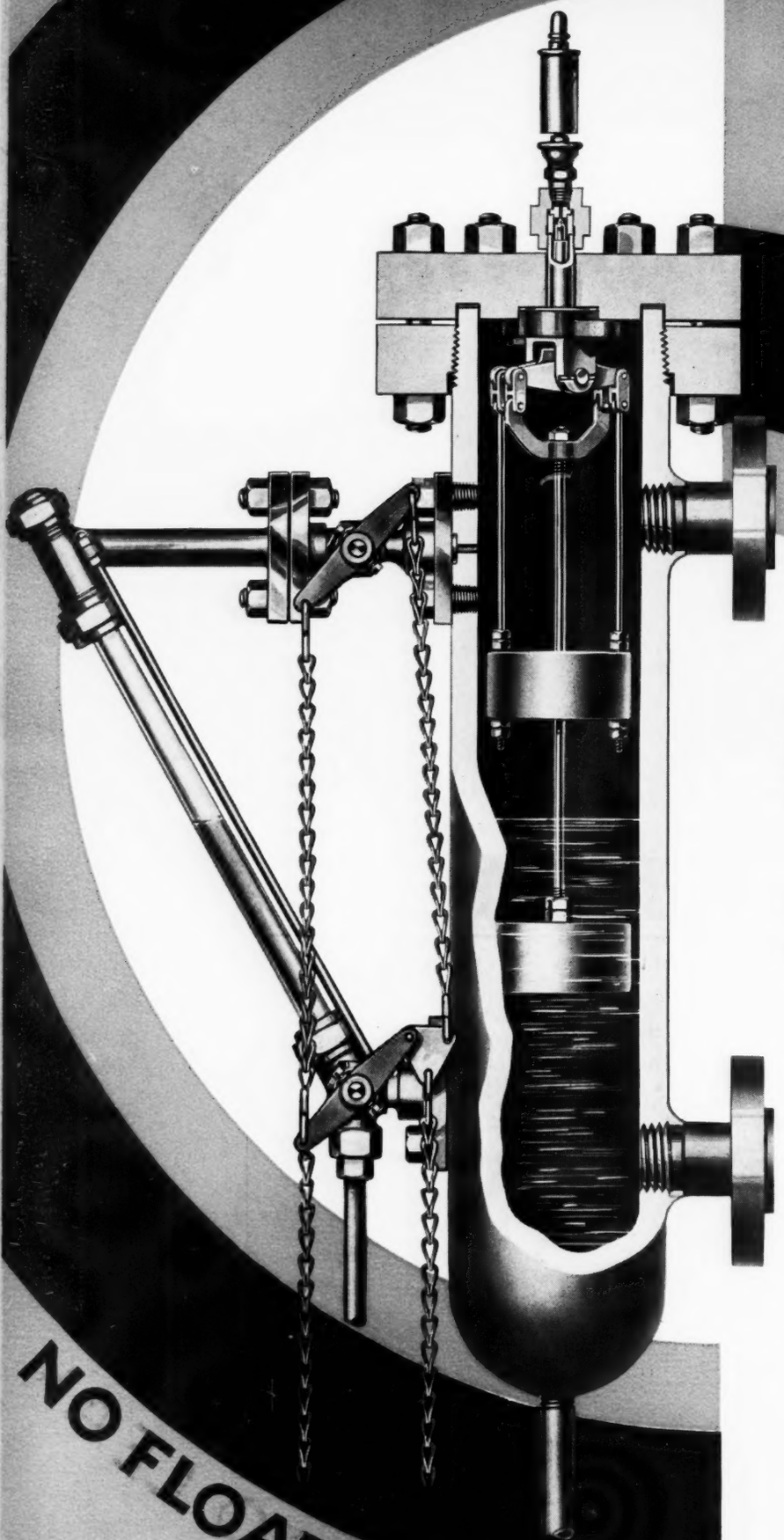
— Send for Booklet B-410-C.

NO SEAT TO LEAK

YARWAY SEATLESS VALVE Operation: — After valve is closed, shoulder S on plunger V contacts with upper follower gland F, forcing it down into body and compressing packing P above and below port.

YARNALL-WARING COMPANY
Mermaid Avenue Philadelphia

YARWAY



FLOATLESS
HI-LO ALARM
WATER COLUMN

and

SE-SURE INCLINED
WATER GAGE

— Operates on the displacement principle with Solid Weights — has no floats.

— Inclined Gage Glass for easy reading of high boiler water levels.

— Used in leading plants from coast to coast; from Canada to the Gulf.

— Made of gray iron and forged steel in types for low and high pressures.

— Send for Booklet WG-1802.

NO FLOATS TO SINK

YARNALL-WARING COMPANY
Mermaid Avenue Philadelphia

MEET THE MOREHEAD ENGINEER . . . .

. . . he is an authority on steam drainage in every branch of industry

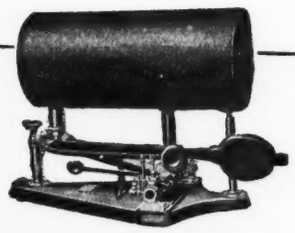
Steam drainage and boiler feeding are the LIFE of the Morehead Engineer. For 37 years, in thousands of plants of every type the nation over, he has devoted all of his time to IMPROVING steam drainage and boiler feeding. By installing the Morehead Back-to-Boiler System he has INCREASED PROFITS for plant owners.

LET the Morehead Engineer explain how the Morehead System will perform these fundamental and vitally important services for YOU:

1. Drains all kinds of steam-heated apparatus . . . immediately and thoroughly.
2. Enables steam-heated apparatus to work at full capacity, thus *increasing production* and *improving quality* of product.
3. **Handles water of condensation at any temperature—212° and above—the higher the better.**
4. Automatically *returns* all condensation to boilers at *original high temperature* . . . thus saving valuable heat units in excess of 212° F.
5. Supplies the boiler with pure, hot, distilled feed water which deposits no scale and, in addition, acts as a most efficient boiler compound in purging the boiler of accumulated scale and dirt.
6. Uses only *ten per cent* of the steam that is required by a pump doing the same work.
7. Eliminates need for a lifting pump, taking the place of such a pump and operating as simply as the law of gravity.
8. Definitely insures *fuel savings* and *lower operating costs.*

MOREHEAD MANUFACTURING COMPANY
Department P DETROIT, MICHIGAN

Morehead
Back to Boiler
SYSTEM



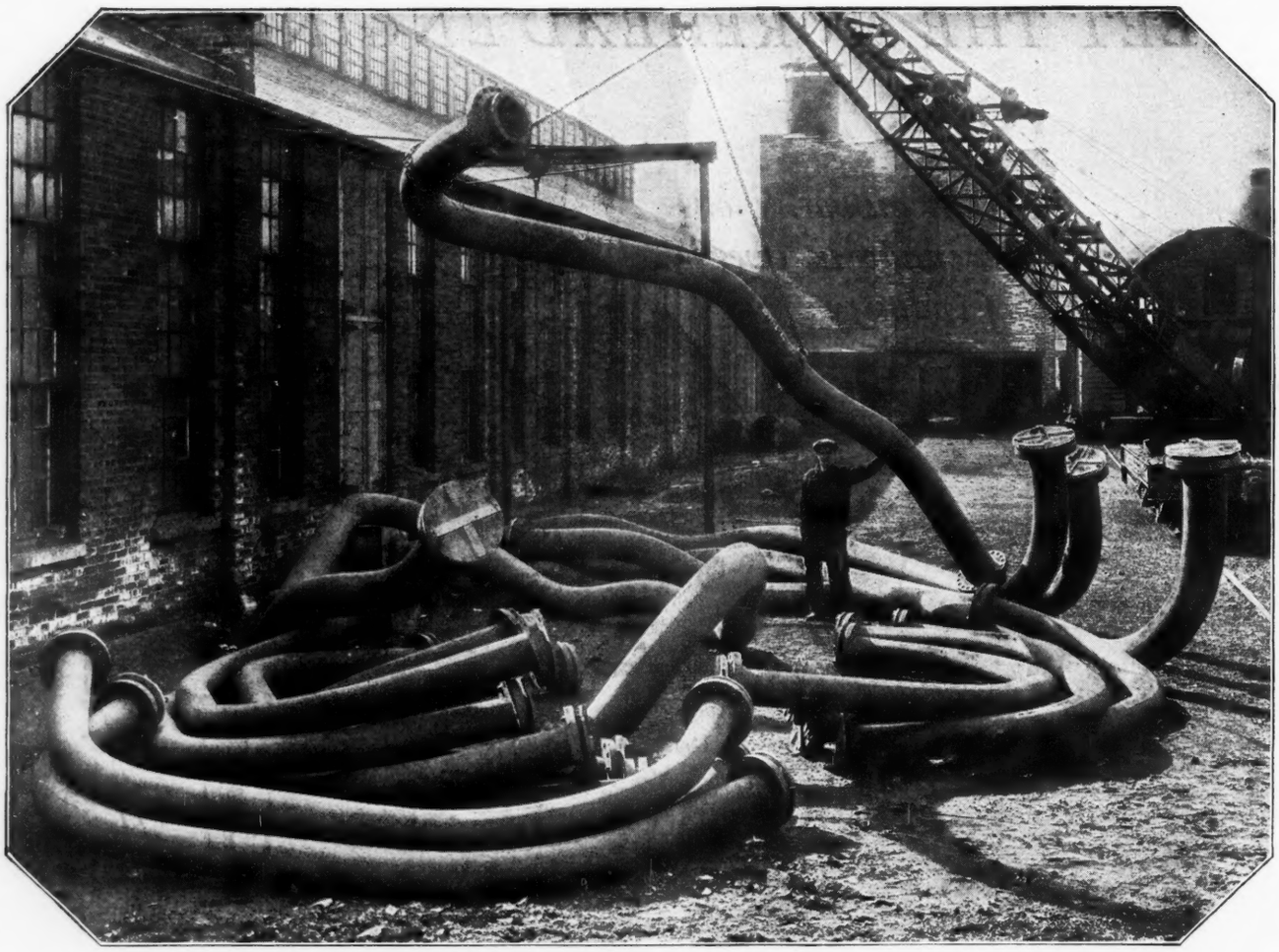
MOREHEAD MANUFACTURING CO., Department P, Detroit, Michigan (418)

I'd like to have your interesting 44-page booklet, giving helpful information regarding the Morehead Back-to-Boiler System. This will, of course, place me under no obligation.

Name_____

Company_____ Address_____

City_____ State_____



IT'S IN KNOWING HOW

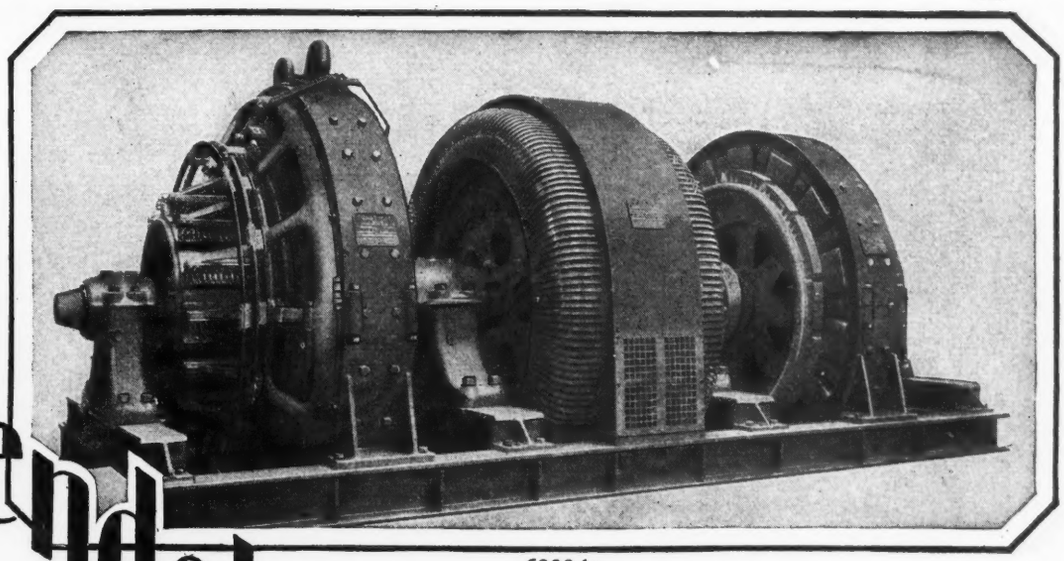
GOOD materials alone do not make a good piping job. It takes expert knowledge of piping, fabrication, proper manufacturing facilities and an unquestionable thoroughness in doing the work right—in other words—it's in knowing how.

When you order piping from Limbert you get the best materials fabricated according to the highest standards of piping craftsmanship. You benefit by our more than 30 years of successful piping fabrication experience.

Geo. B. Limbert & Co.
570 Fulton Street, Chicago

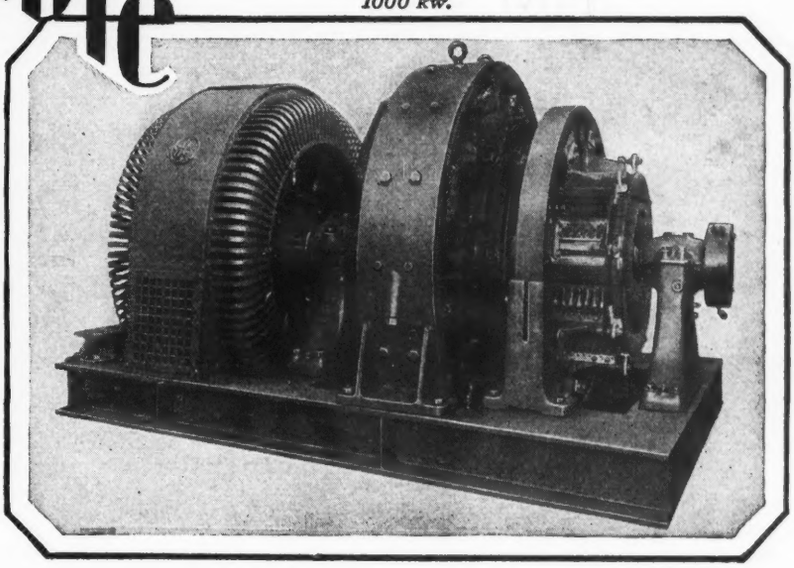
Geo. B. LIMBERT & Co.
PIPING

Dependable and Efficient



6000 kw.

1000 kw.



DEPENDABILITY and efficiency are among the attributes of G-E synchronous-motor-generator sets—built in two or more units; capacities ranging from 50 to 6,000 kw; all standard a-c. voltages and frequencies; 125, 250, 275, and 600 volts d-c. output.

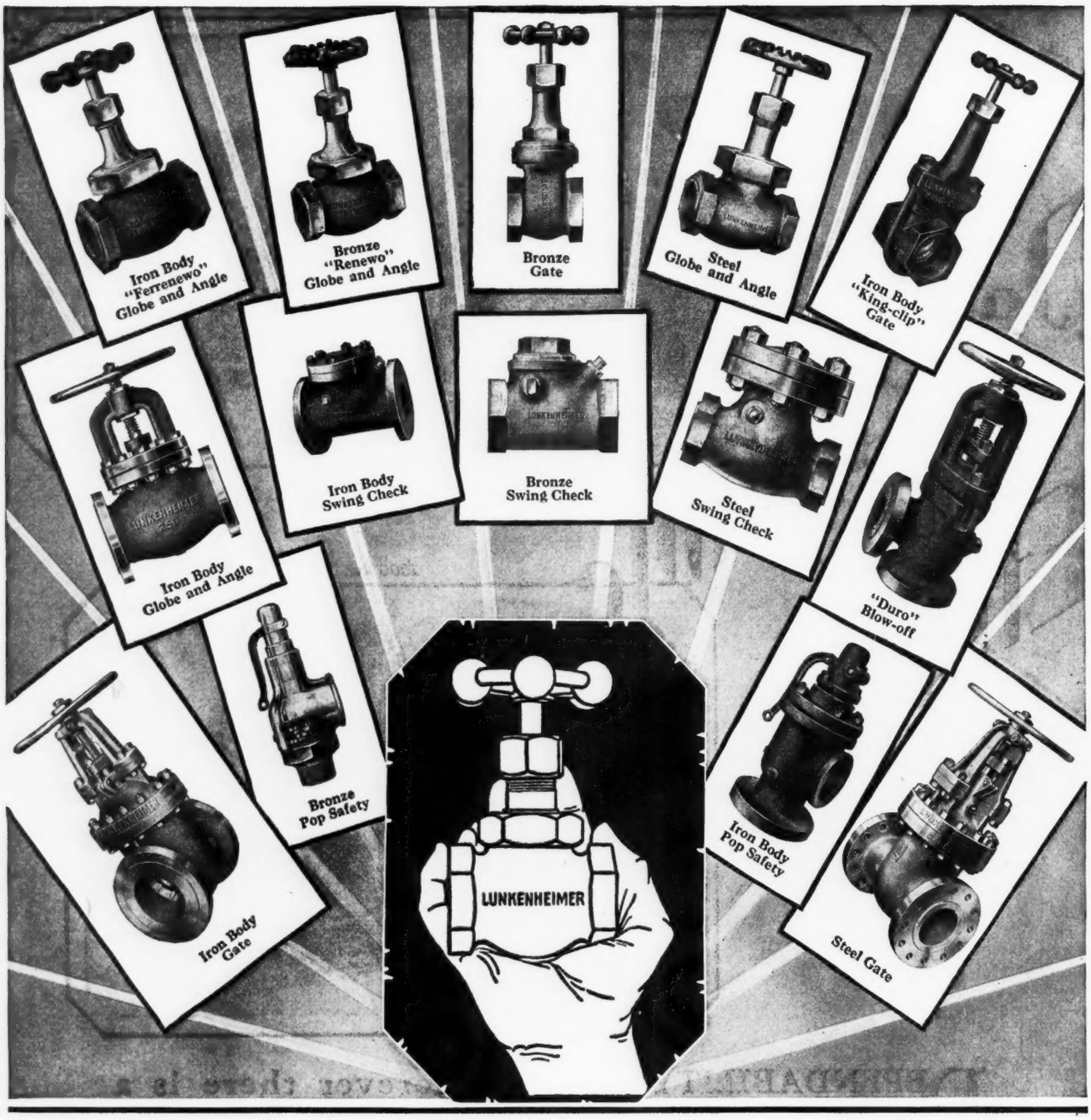
Wherever there is a demand for direct-current power, synchronous-motor-generator sets should receive consideration. We show here typical G-E sets of the new standard ratings, which embody new refinements in both design and construction.

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 9 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

152-1

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES



The Completeness of the Line Facilitates Selection

Valves of bronze, iron and steel, in all commercial sizes; for all prevailing pressures and temperatures; also Boiler Mountings, Lubricating Devices, Whistles, Cocks, Fittings, etc. Descriptive literature will be sent upon request.

Lunkenheimer Distributors, with complete stocks, are located in all industrial centers. They will fill your requirements promptly.

THE LUNKENHEIMER CO.
—"QUALITY"—
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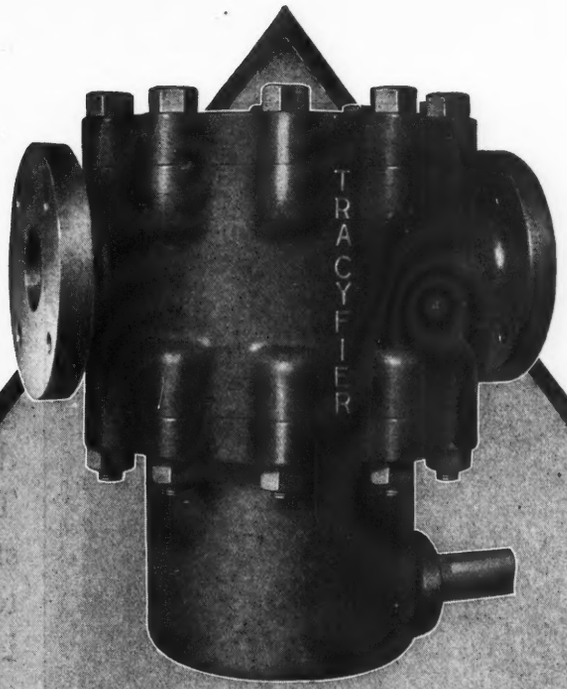
LUNKENHEIMER VALVES

32-66-42



The Pipe Line Tracyfier
Cleans and Dries Steam, Gas, or Air

Absolutely clean, absolutely dry steam, gas, or air guaranteed. (Do not confuse this precision-built instrument with the ordinary separator or strainer.) The removal of all liquid and impurities makes big savings—often repays the cost of the Tracyfier many times a year.

Operates on the same principle as the "boiler drum" Tracyfier used in over 3,000,000 B.H.P. of boilers.

Write for new Bulletin number 1047.

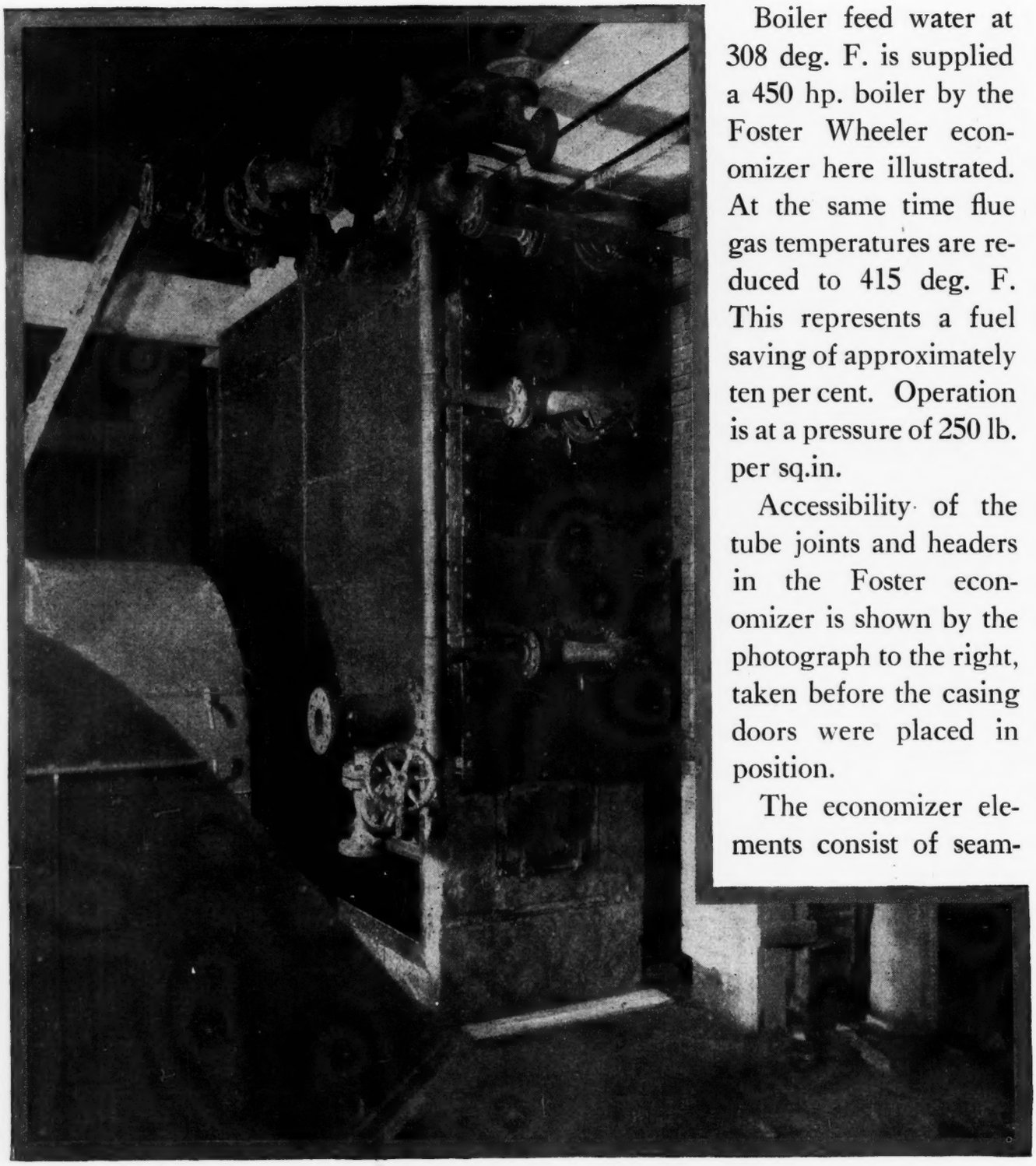
BLAW-KNOX COMPANY

TRACYFIER DEPT.

2051 Farmers Bank Bldg., Pittsburgh, Pa.

BLAW-KNOX

Economizers for



Boiler feed water at 308 deg. F. is supplied a 450 hp. boiler by the Foster Wheeler economizer here illustrated. At the same time flue gas temperatures are reduced to 415 deg. F. This represents a fuel saving of approximately ten per cent. Operation is at a pressure of 250 lb. per sq.in.

Accessibility of the tube joints and headers in the Foster economizer is shown by the photograph to the right, taken before the casing doors were placed in position.

The economizer elements consist of seam-

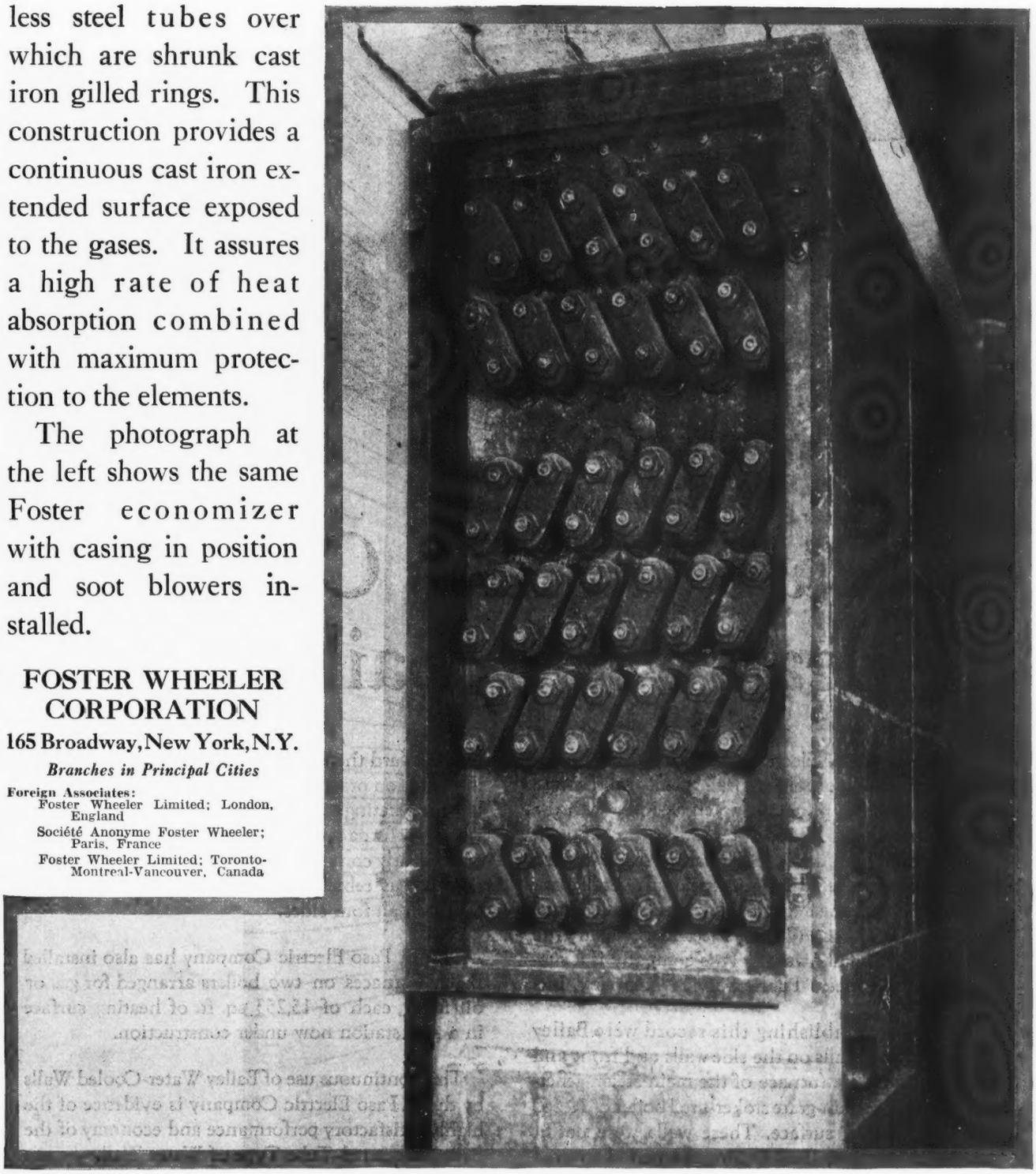
AERO UNIT COAL PULVERIZERS
AIR HEATERS CENTRIFUGAL PUMPS
CONDENSERS COOLING TOWERS
ECONOMIZERS EVAPORATORS
EXPANSION JOINTS FEED WATER HEATERS

FOSTER

Industrial Boilers

less steel tubes over which are shrunk cast iron gilled rings. This construction provides a continuous cast iron extended surface exposed to the gases. It assures a high rate of heat absorption combined with maximum protection to the elements.

The photograph at the left shows the same Foster economizer with casing in position and soot blowers installed.



FOSTER WHEELER CORPORATION

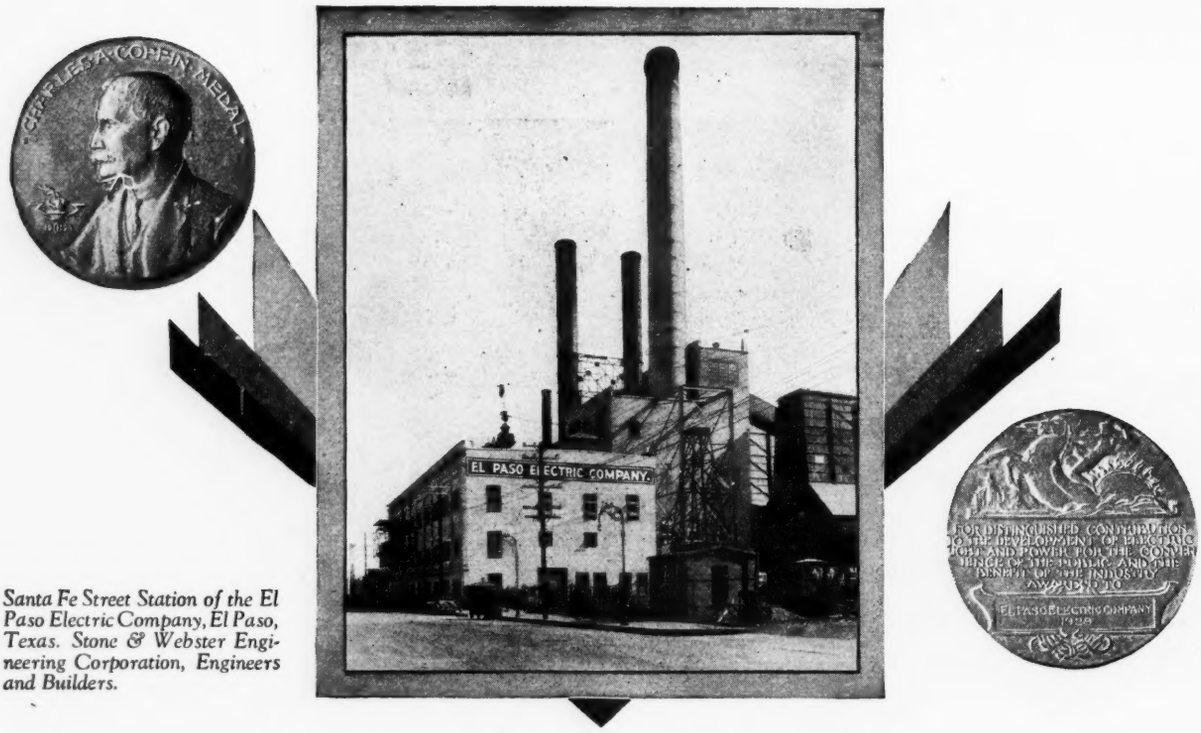
165 Broadway, New York, N.Y.

Branches in Principal Cities

Foreign Associates:
Foster Wheeler Limited; London, England
Société Anonyme Foster Wheeler; Paris, France
Foster Wheeler Limited; Toronto-Montreal-Vancouver, Canada

WHEELER

FRACTIONATING TOWERS HEAT EXCHANGERS
STEAM JET AIR PUMPS SUPERHEATERS
TUBE STILLS VACUUM PUMPS
WATER COOLED FURNACE SURFACES
BRASS AND COPPER TUBING AND PIPE



Santa Fe Street Station of the El Paso Electric Company, El Paso, Texas. Stone & Webster Engineering Corporation, Engineers and Builders.

El Paso Electric Company Repeats With Bailey Walls

THE El Paso Electric Company through the application of efficient management and sound engineering principles was presented with the Charles A. Coffin Award for 1928 at the N.E.L.A. Convention, June, 1929. The citation reads in part, "increase service reliability, exceptional overall plant efficiency . . . are the major achievements which have won for the El Paso (Texas) Electric Company the Charles A. Coffin Award." This company is a subsidiary of Engineers Public Service Company, Inc.

Aiding in establishing this record were Bailey Water-Cooled Walls on the side walls and front and rear arches of the furnace of the main steam-generating unit—a chain-grate stoker-fired boiler of 10,660 sq. ft. of heating surface. These walls were put in service in October, 1927. During the period covered by the award the Bailey-Furnace-Equipped Unit was in operation practically 100 per cent of the time, the boiler operating at as high as 300 per cent rating and with little furnace maintenance expense. The furnace was recently converted for gas and oil firing at which time it was rebuilt to include Bailey Water-Cooled Walls on all four sides.

The El Paso Electric Company has also installed Bailey Furnaces on two boilers arranged for gas or oil firing, each of 15,253 sq. ft. of heating surface in a new station now under construction.

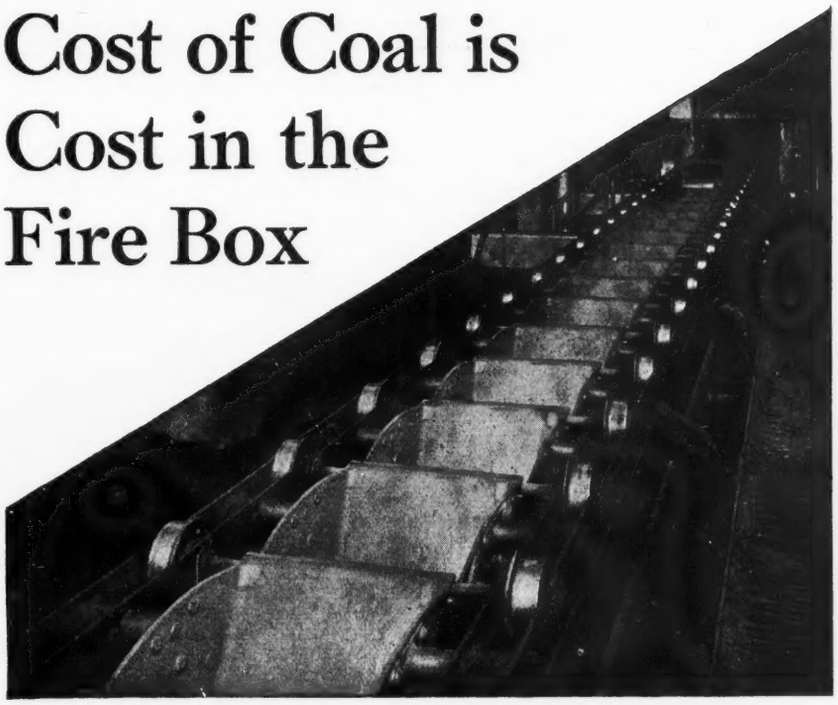
This continuous use of Bailey Water-Cooled Walls by the El Paso Electric Company is evidence of the highly satisfactory performance and economy of the Bailey Protected-Tube Type of Water Wall.

FULLER LEHIGH COMPANY, FULLERTON, PENNA.—*A Babcock & Wilcox Organization* 1-132

FULLER FL LEHIGH

PULVERIZED-COAL EQUIPMENT — WATER-COOLED FURNACE WALLS

Cost of Coal is Cost in the Fire Box



Give it a Ride!

Cost of coal in the car on your siding—and cost in the fire are two different items.

Discouragingly different, unless your coal handling methods take advantage of the most modern equipment with its vital economies.

For years Jeffrey has been at work, studying, improving coal and ash handling equipment. Giving your coal and ashes a "Ride with Jeffrey Equipment" means the very best which handling practice has to offer.

First in the Jeffrey group comes the Pivoted Bucket Carrier. No finer equipment is to be found anywhere. Handles both coal and ashes. Buckets always pivot perfectly due to glass hard double bushings in trunnions. Protected against wear at all vital points. No rods through buckets.

V Bucket Conveyors by Jeffrey offer maximum development of this type. Will do all a scraper conveyor can—in addition takes vertical lifts.

Jeffrey Belt Conveyors—Plain, Bronze Bushed, or Roller Bearing Pulleys—useful for long horizontal runs or fairly gradual incline.

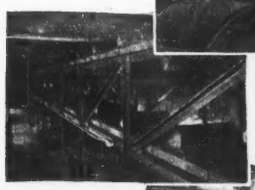
Spiral Conveyors—As these require no return flights, they can be installed in very close quarters. Also they may readily be made absolutely dust proof.

Scraper Conveyors—Drag Chains—Skip Hoists — Bucket Elevators — Crushers — Pulverizers—Weigh Larries—Apron and Reciprocating Feeders—the Jeffrey line is complete.

Send for our literature on coal and ash handling equipment—it gives full details on all these items which can only be touched upon here.

Jeffrey Equipment for Handling Coal & Ashes

Pivoted Bucket Carrier—Coal & Ashes



V-Bucket Conveyor —Coal

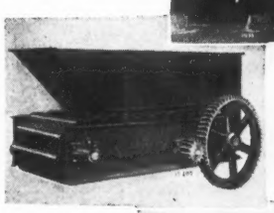
Belt Conveyor—Coal

Scraper Conveyor —Coal

Spiral Conveyor —Coal

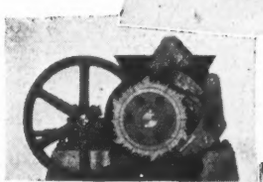
Bucket Elevator—Coal or Ashes

Skip Hoist—Coal or Ashes

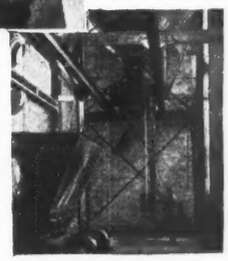


Apron Feeder

Reciprocating Feeder



Crusher and Pulverizers



Weigh Larries

The Jeffrey Manufacturing Company

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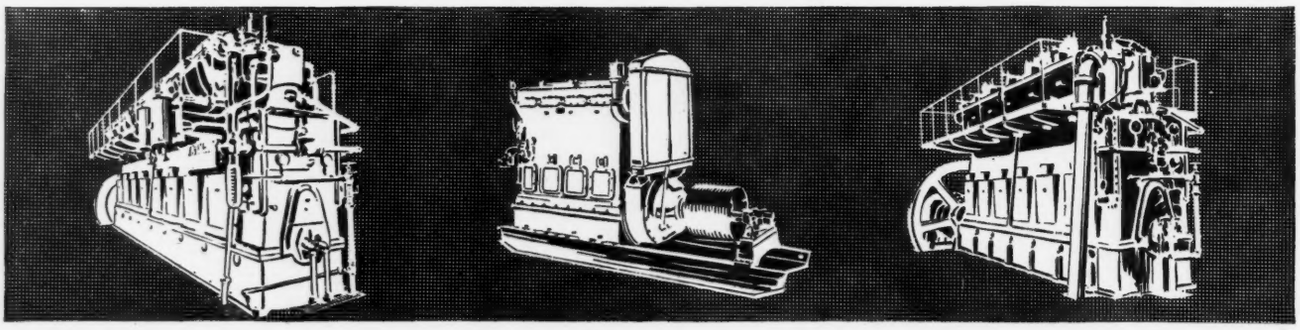
Jeffrey Manufacturing Company, Ltd. of Canada
Head Office and Works, Montreal. Branch Office, Toronto

JEFFREY

MATERIAL HANDLING EQUIPMENT



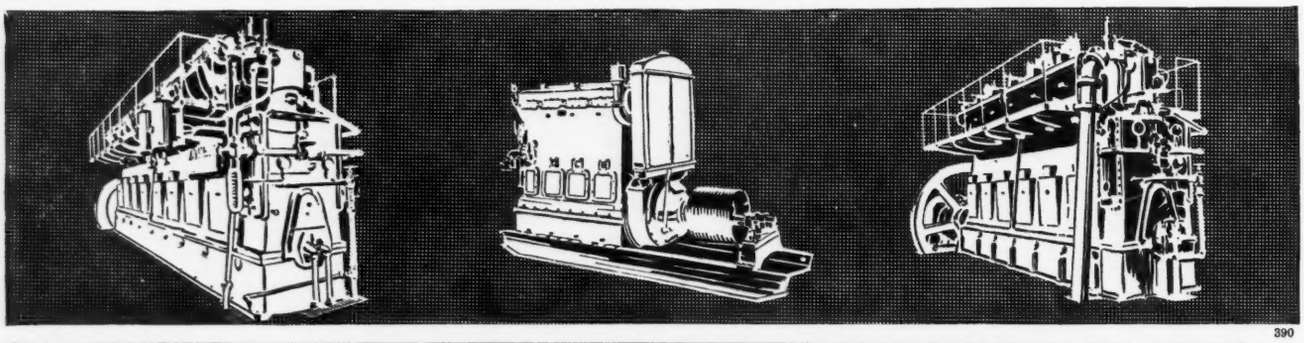
THE DIESEL

During the past twenty years industrial power users have recognized the Diesel Engine as a power source — but comparatively few realize that Diesels have been economically applied — and in constantly increasing volume — to furnish power of all classifications.

Performance records taken from nearly every industry have demonstrated the economy and long life of the Diesel Engine — vital points that progressive executives cannot ignore.

The Fulton Iron Works Company, one of the pioneer American Diesel builders, will gladly furnish complete information on Diesel application to anyone interested in reducing power costs .... Fulton-Diesels are built in sizes of from 50 to 2000 H.P.....Fulton Iron Works Company....St. Louis, Missouri.

SUCCESSFUL ENGINE BUILDERS FOR OVER SEVENTY-FIVE YEARS



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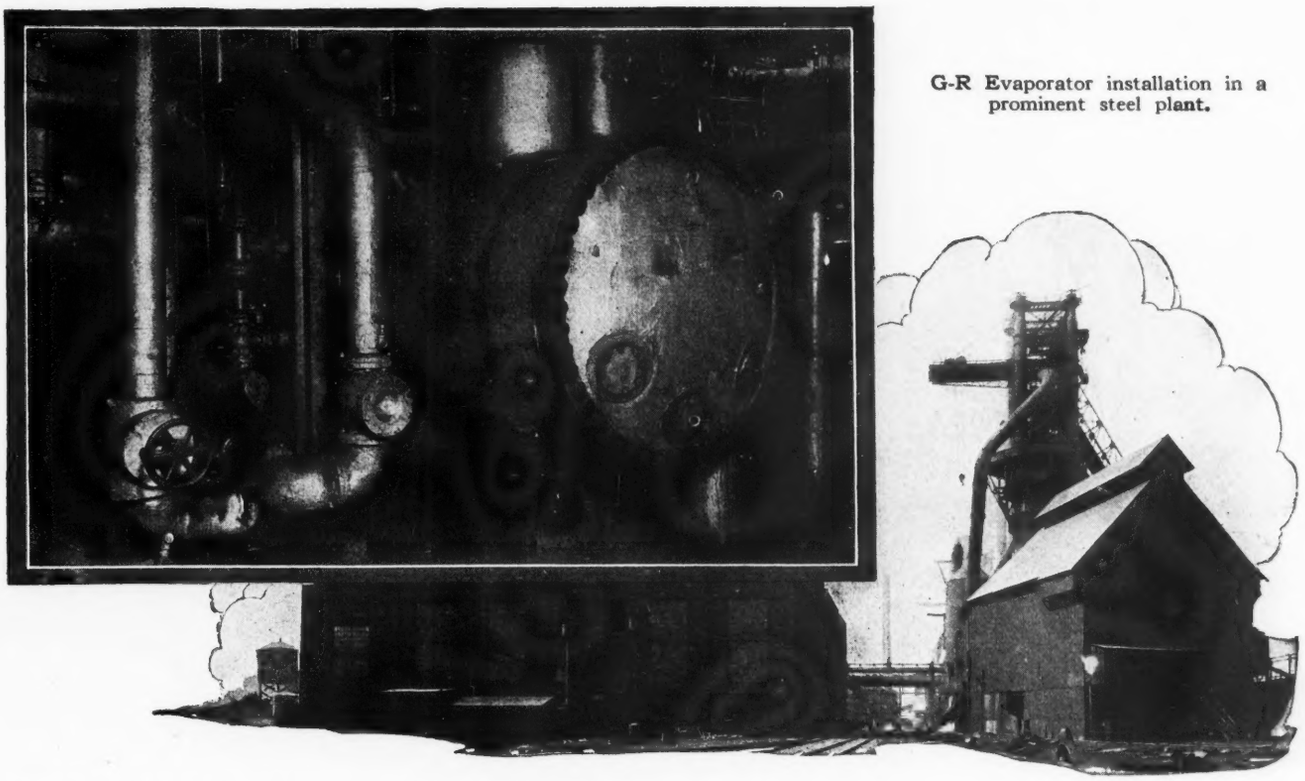

G-R Evaporator installation in a prominent steel plant.

Distilled boiler feed make-up—

a profitable investment for industrial plants as well as for central stations

G-R Evaporator Systems supply over 10,000,000 B. Hp.

WHILE evaporator systems for distilling the make-up water to boilers were first used in central stations, their many advantages soon brought about their application to industrial plants as well.

Today a large number of industrial plants, after investigating the benefits of boiler feed make-up purification by distillation, have installed G-R Evaporator Systems. Besides producing an ideal boiler feed from hard, salt or dirty raw water thereby reducing boiler maintenance and permitting continuous boiler operation at high ratings, these systems pay for themselves in eighteen months or less through the fuel savings which they effect.

No matter how poor the quality of your raw water supply may be, it will pay you to investigate how it can be purified by low cost distillation in a G-R Evaporator System without the use of chemicals.

THE GRISCOM-RUSSELL COMPANY
285 Madison Ave., New York

Philadelphia	Chicago	St. Louis	San Francisco
Boston	Detroit	Kansas City	Los Angeles
Rochester	Cleveland	New Orleans	Seattle
Buffalo	Indianapolis	Charlotte	Portland
Pittsburgh	Cincinnati	Houston	Denver
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For Canada: Riley Engineering and Supply Company, Ltd., Toronto

Griscom-Russell

Heat Transfer Apparatus

SEAMLESS IRON TUBES

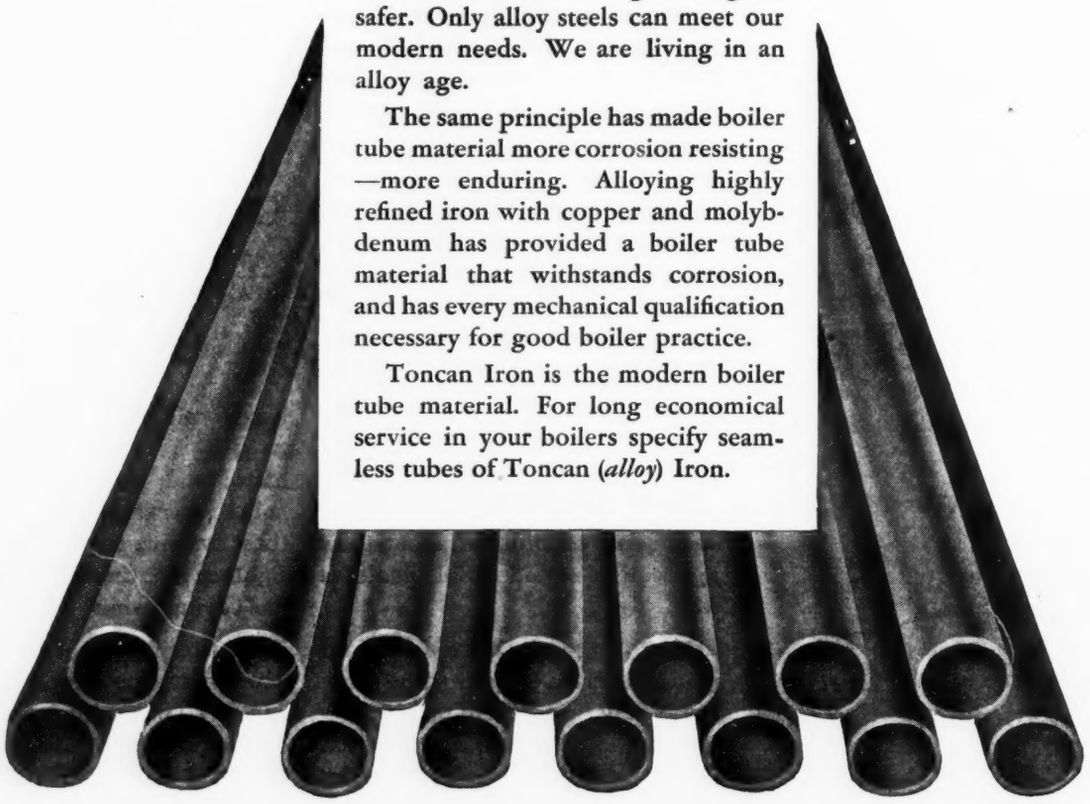
Made from Toncan (*Alloy*) Iron for longer service

METALLURGICAL development has brought new qualities to boiler tube materials.

The alloying principle made our automotive steels stronger, tougher, safer. Only alloy steels can meet our modern needs. We are living in an alloy age.

The same principle has made boiler tube material more corrosion resisting —more enduring. Alloying highly refined iron with copper and molybdenum has provided a boiler tube material that withstands corrosion, and has every mechanical qualification necessary for good boiler practice.

Toncan Iron is the modern boiler tube material. For long economical service in your boilers specify seamless tubes of Toncan (*alloy*) Iron.



Toncan Iron, an exclusive product of Central Alloy Steel Corporation, is worked into seamless tubes by

THE BABCOCK & WILCOX TUBE CO.

Works and General Offices:
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REG. U.S. PAT. OFF.
TONCAN
COPPER
Mo-lyb-den-um
IRON

Seamless Tubes

General Sales Office:
85 Liberty Street
New York

Heat made the metal warp

but failed to impair the tightness of

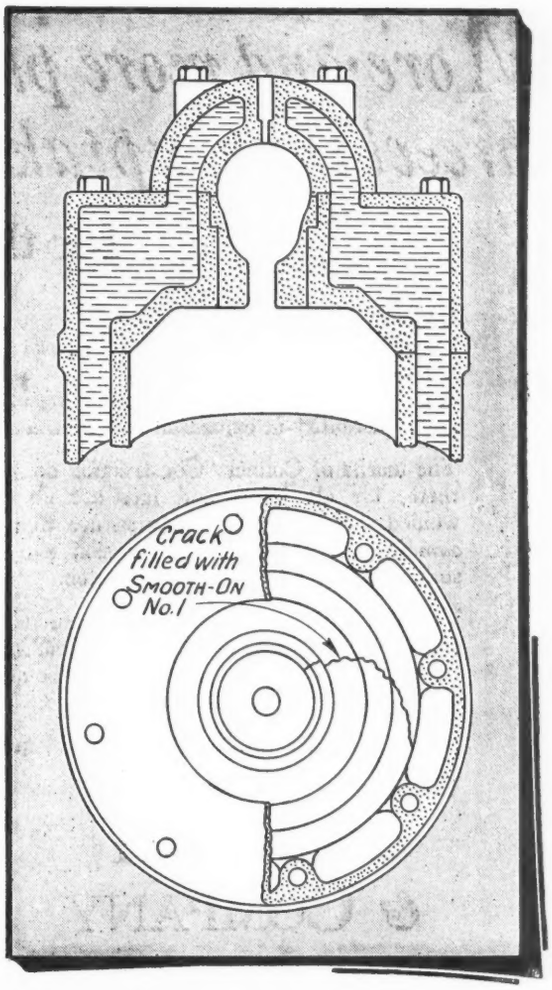
SMOOTH-ON No. 1

filled into a crack

A CRACK 6 inches long and semi-circular in shape developed in the cylinder head of an oil engine used for pumping in a Nebraska plant. This crack was right on the end of the cylinder head, partly in the cup next to the combustion chamber, and partly in the combustion gasket seat.

The head was taken to a welding shop in a nearby city, where the mechanic tried both a torch and electric welding without satisfactory results. He advised getting a new head.

The Plant Engineer would not do this until after attempting a repair with SMOOTH-ON No. 1. He cleaned out the crack and rammed it full of SMOOTH-ON No. 1. Afterwards he ran this head for three months without leakage at the crack, and he believes that the SMOOTH-ON repair would have lasted for years, had not replacement of the head become necessary on account of warping.

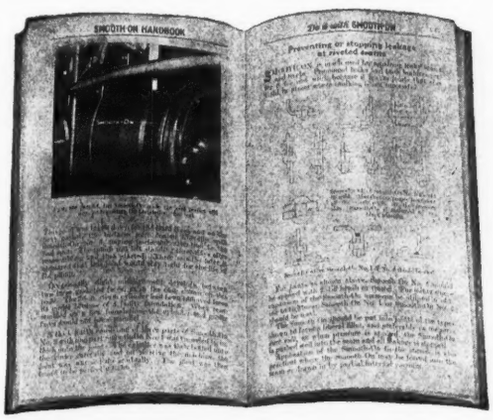


Such a repair—with high-frequency high-temperature high-pressure oil explosions on one side and comparatively cold water on the other—is an extremely severe test, yet the SMOOTH-ON held.

The SMOOTH-ON Handbook explains how SMOOTH-ON should be applied to resist any or all of these conditions perfectly.

This BOOK FREE
if you mail the coupon

Twentieth Edition—136 pages of data—193 diagrams, pictures and practical hints on at least 200 different uses for SMOOTH-ON. Every progressive engineer should have this book—get your copy NOW.



Get your copy by mailing the coupon and get SMOOTH-ON No. 1 in 1 or 5-lb. can or 25 or 100-lb. keg from your dealer or if necessary from us.

SMOOTH-ON MFG. CO., Dept. 30, 570 Communipaw Ave., Jersey City, N. J.
Please send copy of the SMOOTH-ON HANDBOOK, 20th Edition.

Name .....

Address .....

.....

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12-31-29

SMOOTH-ON

More and more plants are specifying flues, breechings, uptakes, ducts, by Connery

for these reasons:

Connery Construction is based on a sound principle—that of the accordion. "V" shaped projections, like the pleats of the accordion are pressed into the sheets while cold, thus allowing for maximum flexibility in expansion and contraction.

The merits of Connery Construction do not stop there, for all joints and laps are electrically welded making it air and moisture tight, thus avoiding the leakage and corrosion dangers of sliding joints and riveted construction.

The corrugations of Connery Construction have proved by test to be as strong as I-beams. The entire simplicity of design eliminates the need for angle irons or numerous supports.

Because of its uniform expansion qualities, Connery Construction lends itself to the lining of the flues with a refractory material.

Connery's Improved Expansion Stiffener Construction is ideal for both short flues and long flues—such as boiler breechings, preheater ducts air ducts and uptakes.

Expensive? No, Connery Construction with all these advantages COSTS NO MORE than regular construction. To prove it ask for a Connery bid on your next job.

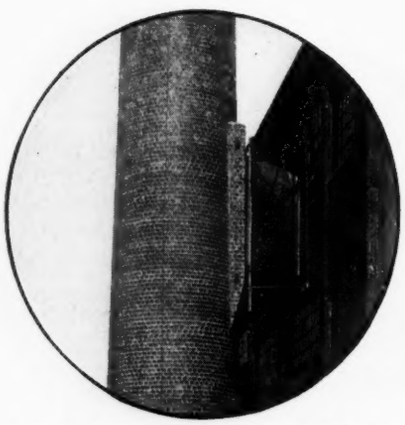
The vast majority of power plants and central stations have standardized on Connery Construction.

You can't afford to ignore it. Write!

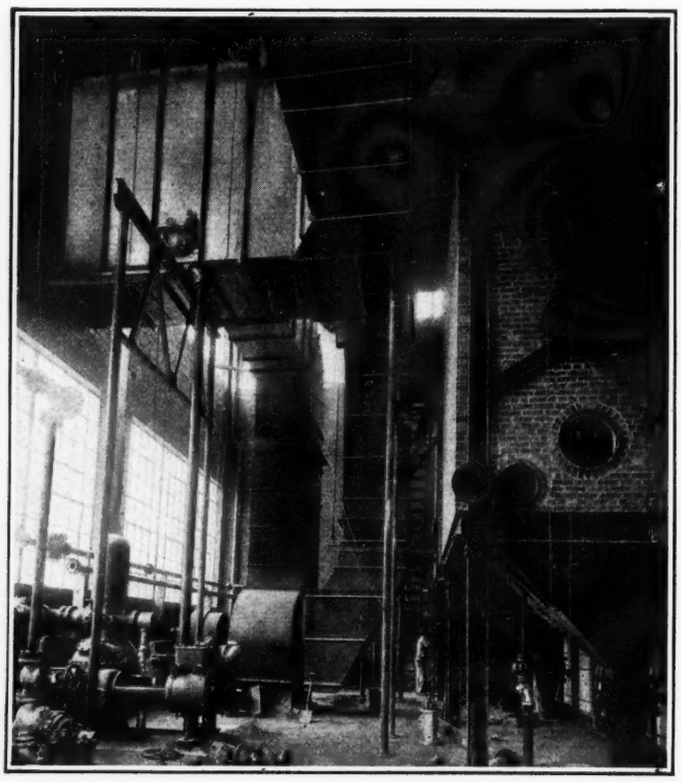
CONNERY & COMPANY

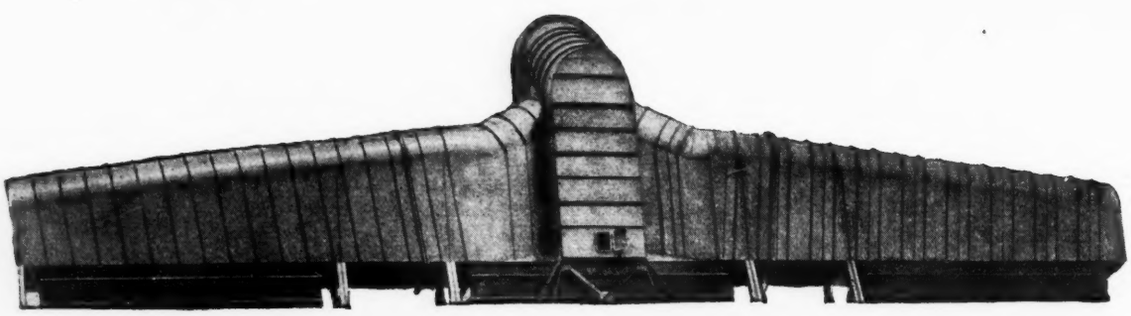
Second and Luzerne Sts.,
Philadelphia, Pa.

Branch Offices, New York



Connery Construction at American Salpa Co., Spotswood, N. J.





POWER

A McGRAW-HILL PUBLICATION—ESTABLISHED 1884

FRED R. LOW, *Editor*

Volume 70 NEW YORK, DECEMBER 31, 1929 *Number 27*

Valedictory

I HAVE been editing *Power* for over forty years. In a few months I shall have attained the allotted years of man.

The time has come for me to say, with Falstaff, "Well, I cannot last forever. If you will needs say I am an old man you should give me rest."

The owners and managers of *Power* have been generously considerate of my lessening endurance, and for some years I have been expected to exercise only that general oversight of, and interest in, the paper of which it would be difficult for one who has lived with it so long to divest himself.

To those who have done the real work of making the paper in the meantime the credit which has inured to me as its titular editor is really due; and for their loyal support and consideration of my responsibility for their product I am profoundly grateful.

However kindly the fates, and the company, may continue to be to me, it is apparent that *Power* should have a responsible editor who is really active and in more intimate touch with its field and personnel than I can hope longer to be.

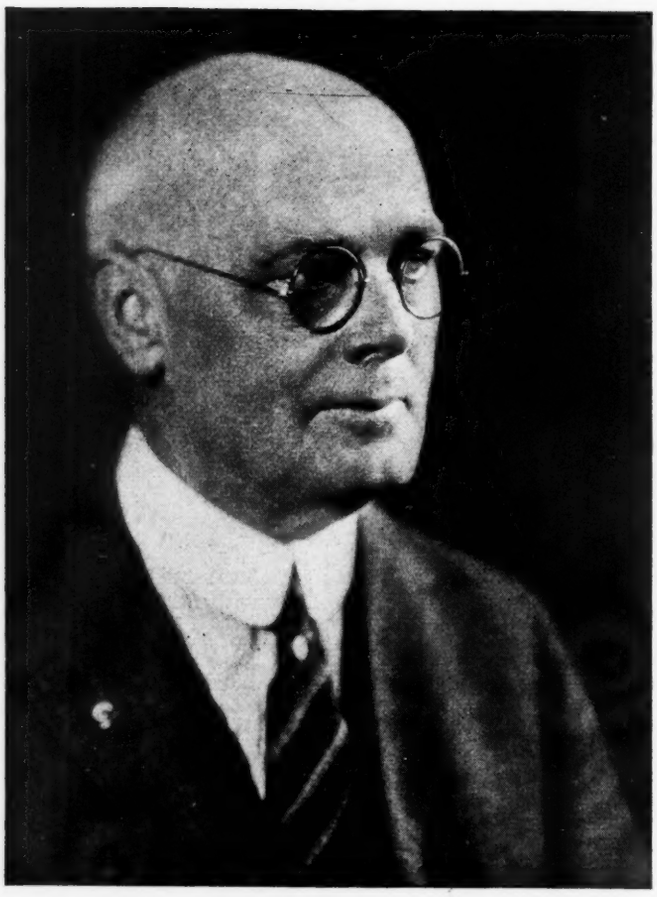
With this issue, therefore, I am resigning to Mr. Ely C. Hutchinson the responsibility of carrying *Power* on to further usefulness and to new achievements. I bespeak for him, and for the continuing staff, the coöperation and kindly consideration that have made my years of fellowship with the readers so enjoyable and helpful to me.

And as for myself, this is not in a strict sense a valedictory. I simply move from the editorial desk to the big armchair, where, as Editor Emeritus, I hope for some years yet to have an advisory part in the conduct of the paper and to scribble a weekly chat to my friends upon this page.

F. R. Low

IN FULNESS of years and of honors, blessed with the affection and high regard of his professional associates and a host of friends in industrial and private life, Fred R. Low relinquishes the editorship of *Power*.

Institutions are but the reflections of men; and this is peculiarly true in the field of industrial publishing. Behind every great paper is a great editor. For more than forty years, Fred R. Low, as editor of *Power*, has maintained leadership for this publication. By his broad vision and personal understanding, not only has he helped shape the destiny of the field to which he has devoted his life, but many men now prominent in power engineering are proud to acknowledge his influence.



When Fred Low became editor of *Power*, a five-hundred horsepower engine was large; a boiler that would make five thousand pounds of steam at one hundred pounds pressure was something to be wondered at; the steam turbine had yet to be developed; and the electrical industry was an infant in swaddling clothes. Witness the picture today with boilers producing a million pounds of steam per hour; steam pressures of fourteen hundred pounds in every-day use; steam turbine units of over two hundred thousand kilowatts capacity; and the country covered with a network of transmission and distribution lines at the service of industry and mankind.

Few men have been privileged to observe first-hand this phenomenal progress in power generation and application. Fewer still have played a leading part in directing this progress; and most of these have been concerned with particular phases of the development. It has been Mr. Low's privilege both to observe and to contribute in the broadest sense to this progress during the entire period.

A great editor, given time, will build a paper that will continue to unfold his vision and embody the spirit of his work long after he has relinquished its active direction. That is why the keen personal loss I feel at Mr. Low's retirement from the active direction of *Power* is tempered by a profound conviction that the spirit woven into its fabric through these forty years will continue as the paper moves on to even greater service.

To readers, F. R. Low and *Power* are inseparable. It is therefore fitting that, although he relinquishes the active editorship to younger hands, he will continue to contribute his signed editorials and thus each week bring a new message to his many friends and admirers. His host of friends will join our company executives and his associates in wishing him many years of health and happiness to enjoy a greater measure of leisure.

James H. McGraw

SUCCESSION to the editorship of an industrial publication, particularly one of the age and prestige of *Power*, is a matter of more than casual concern. It is of direct and vital interest to reader, manufacturer and publisher, all of whom look to the editor for intelligent leadership and enterprise in recording events, interpreting developments, directing thought and molding opinion. With this responsibility in mind it is with pleasure that the publisher announces the appointment of Ely C. Hutchinson as Editor of *Power*. Through training and experience, knowledge and ability, temperament and personality, it is confidently believed that Mr. Hutchinson possesses the qualifications for his new post.

Mr. Hutchinson joined the McGraw-Hill organization several months ago after a ripe experience in the profession and industry served by *Power*. Beginning as a pattern-maker's apprentice, he worked successively as a draftsman and then as a designer of engines, hoists, compressors and mining machinery. Subsequently he engaged in the selling of engineering products and was variously employed as engineering salesman, manager of sales and chief engineer of important corporations in the power field. Since 1922 he has been President and General Manager of the Pelton Water Wheel Company.

His professional and social activities in the field of mechanical engineering have been no less varied. In the American Society of Mechanical Engineers he was one of the organizers of the hydraulic division, was its Chairman for the first two years and is now a member of its Executive Committee. He is also a member of the Hydraulic Power Test Code Committee and of the Library Committee. Recently he was elected a member of the Board of Management. He is a past chairman at the San Francisco Section A.S.M.E., and was also President of the Engineers' Club of that city. He is the inventor and patentee of numerous mechanical devices in hydraulic engineering and has contributed to engineering literature on economic and technical subjects.

Thus he brings to the readers of *Power* a fundamental qualification, enhanced by well-rounded experience, and a habit of thinking that is peculiarly adapted to his new duties.

The McGraw-Hill organization bespeaks for Mr. Hutchinson a continuation of that support and confidence which Mr. Low so ably won and merited. And in extending its felicitations to Mr. Hutchinson, the company likewise extends to the clientele of *Power* assurance of that support and co-operation which is so necessary to adequate service and successful achievement.

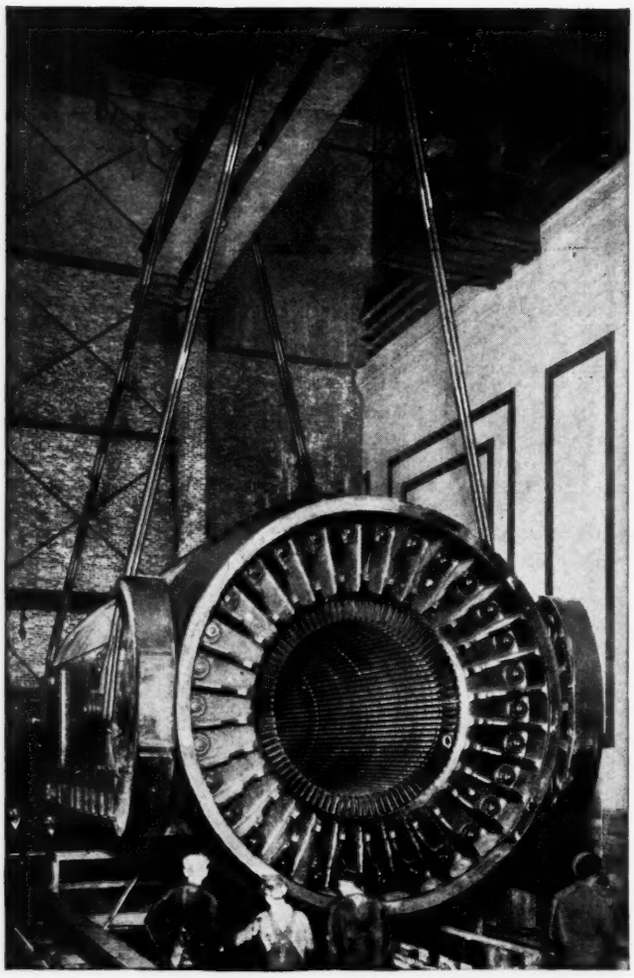
Malcolm Muir

160,000-KW. GENERATOR C

the New York Edison C

By D. S. SNELL

A.-C. Engineering Department
General Electric Company



THERE has recently been installed in the Fourteenth Street Station of the New York Edison Company a 160,000-kw. unity power factor, three-phase, 25-cycle, 1,500-r.p.m., 11,400-volt generator. This generator is the largest single-shaft unit yet built, and its unusual size required the incorporation of a number of novel features in design and construction.

In the design of the machine stator, considerations of handling and shipment required an exceptionally light and strong frame structure. This was secured by eliminating all castings in the frame design, and instead, using a welded-plate construction. The frame consists principally of a number of plate-steel annular rings held together axially by steel plates welded to their outer peripheries. To the inner peripheries of the annular rings are welded a number of steel bars. These bars serve as supports for the core laminations, as clamping bolts for the flanges which restrain the core at either end of the frame, and also add stiffness to the frame structure. The frame was constructed in halves, to facilitate shipment, and the core and winding were assembled in it at the station.

A novel arrangement was used for handling the finished stator core. Because of the necessity for assembling the core with the stator frame standing in a vertical position, the stator had to be turned through 90 deg. before the winding could be installed or the generator assembled on its base. The method usually employed for doing this is to first lift the stator from its assembly base, using a pair of trunnions mounted op-

Fig. 1 (Above)—Generator's stator frame with the core assembled being carried by two 200-ton cranes to its base for winding

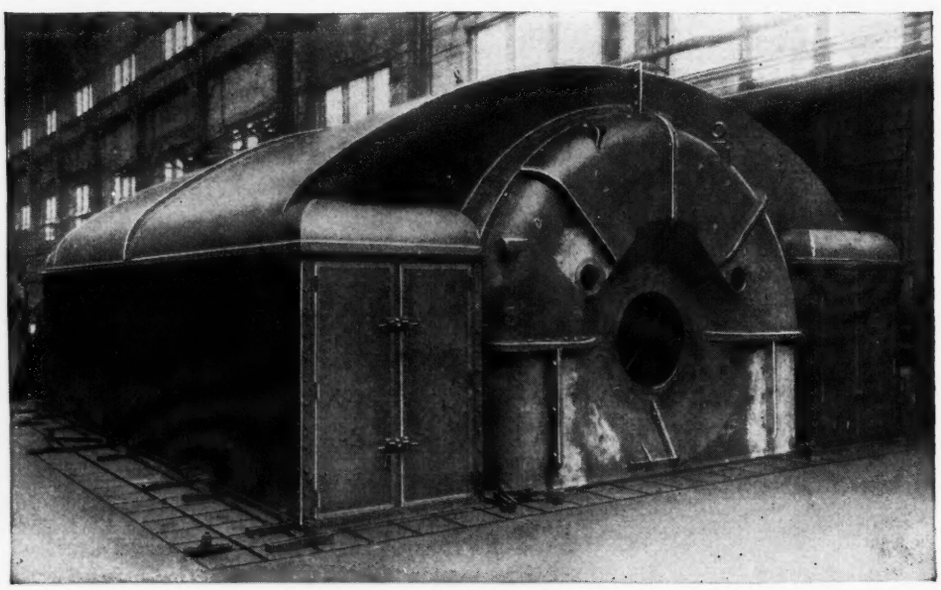


Fig. 2 (Right)—Generator's ventilating housing and end shield. End view shows the doors providing access to the air coolers

Goes Into Operation at

Company's Plant

Many interesting mechanical features are involved in a generator of this size, which is the largest single-shaft machine yet built. To facilitate shipment and handling, the stator frame was made of welded plate construction and a special method of handling it had to be devised. The ventilating-air cooling system is of unusual arrangement—used for first time in this country.

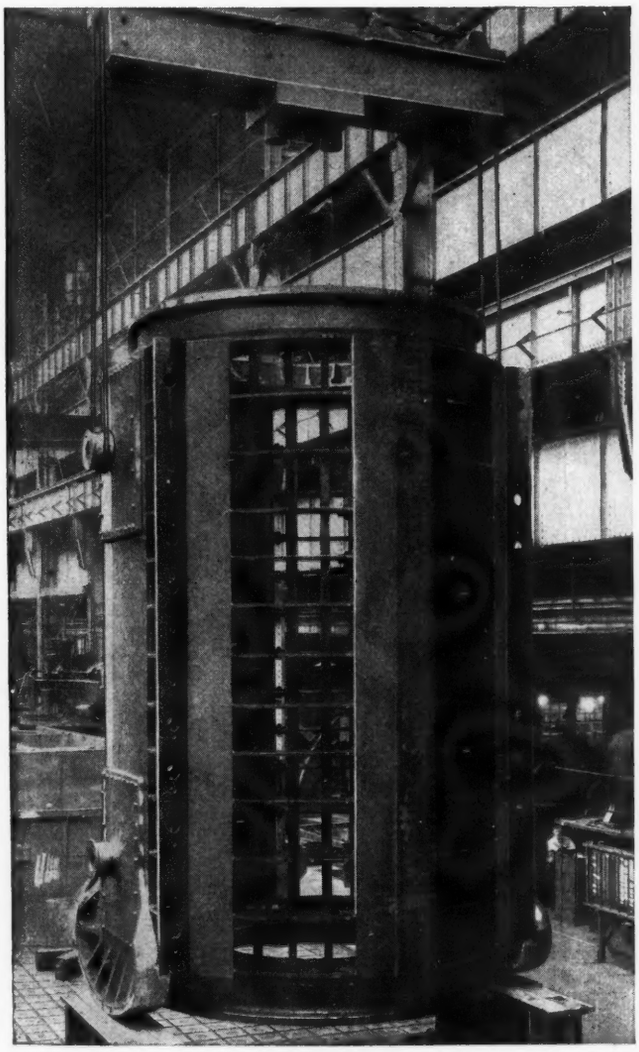


Fig. 3—The stator frame in the vertical position for assembling the core

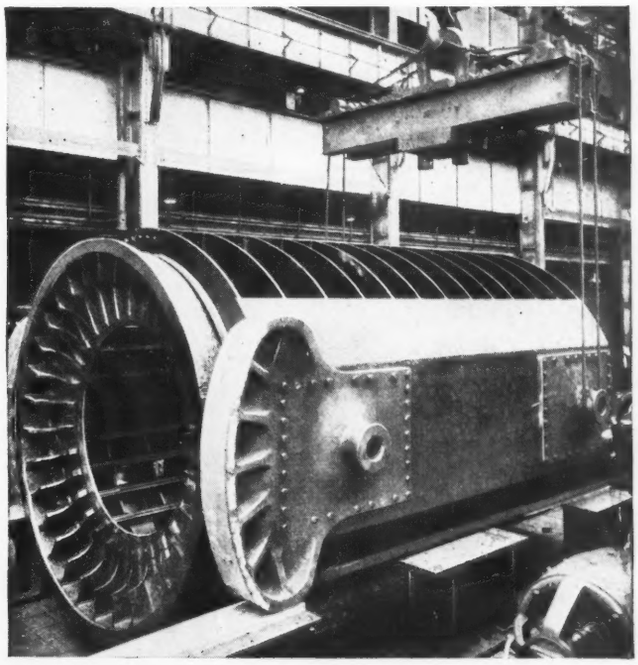


Fig. 4—Rocking trunnions mounted on one end of the stator were used to turn it to the vertical position

posite its center of gravity, and then to rotate the stator, while supported on the trunnions, to a horizontal position.

This procedure was impracticable in the present case, owing to the weight of the stator core. As the stator with its assembled core weighs approximately 350 tons, it could be lifted from its vertical position, if at all, only by the use of the station's two 200-ton cranes, and the employment of a very heavy and expensive lifting rig. Excessive strains would be produced in the stator frame if the assembled core were lifted and turned in the usual manner. The arrangement used for turning this stator was one in which it was rolled, instead of lifted, from a vertical to a horizontal position, and required the use of but one crane. The equipment consisted of two large rocking trunnions, mounted on one end of the stator's frame; and a specially constructed base.

The operation followed in turning the stator with its assembled core from a vertical to a horizontal position, is indicated in Figs. 3 and 4. Fig. 3 shows the stator frame in the position for assembling the core, the weight of the core and frame being carried on the rocking trunnions. Blocking was placed beneath the frame to prevent its turning on the trunnions while the core was being assembled. The base upon which the trunnions rested consisted of two large girders, of a length greater than that of the stator frame, and having a depth sufficient to allow room below the frame for the device used in compressing the core during assembly. Strips of copper $\frac{1}{4}$-in. thick were placed between the surfaces of the trunnions and the girders to prevent slipping as the stator was being turned. After the core had been assembled, a specially designed lifting rig consisting of two large I-beams, was attached to one of the station cranes and to the pair of lifting trunnions at the upper end of the frame. The blocking beneath the frame was then re-

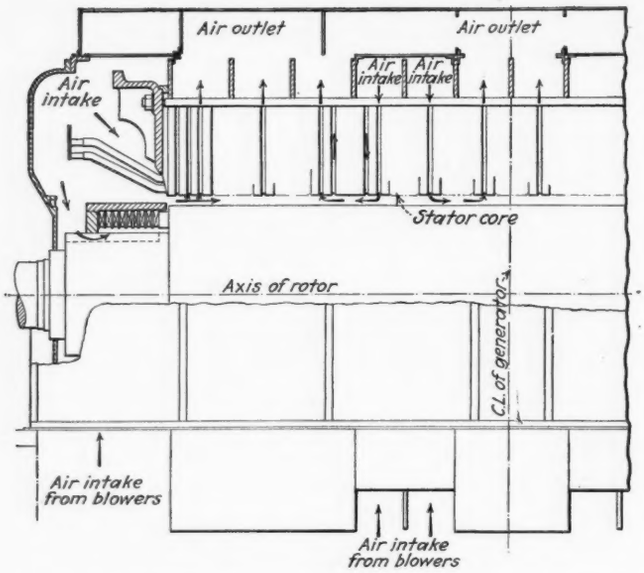


Fig. 5—Section through the generator showing the path of the ventilating air

Four blowers discharge the cooling air into a common chamber, located directly beneath the generator, from where it flows upward into the end bells and annular chambers, the latter formed by the stator frame plates surrounding the core. Approximately 160,000 cu.ft. of air per min., at a static pressure of 9 in. of water is required..

moved and the stator was slowly lowered to a horizontal position, Fig. 4.

The assembled stator core was then lifted from the special assembly base and moved to the generator base, where the stator winding was installed. This lift was accomplished by the use of the two station cranes in conjunction with the special lifting rig used in turning the stator, slightly modified. Fig. 1 shows the assembled core as it is being carried to the generator base, and indicates the huge proportions of this machine.

The rotor, shown in Fig. 7, consists of three separate steel forgings, a hollow body section and two solid end pieces, which were shrunk and bolted solidly together. Heavy steel rings are fitted over the end projections of the field windings, holding them in place against centrifugal force. The body part of the rotor alone weighs 228,000 lb., and was the largest single forging ever produced by the steel mills. It required, in its manufacture, a billet weighing 465,000 lb. The completed rotor weighs 262,000 lb., and was shipped on a specially-built flat car.

Generator Ventilation

Ventilation for the generator is supplied by four centrifugal blowers, which circulate the air in a closed-circuit system. Surface coolers are provided for removing from the ventilating air the heat absorbed by it in passing through the generator. In most large turbine-generator installations employing the closed-circuit system of ventilation, the air coolers are placed beneath the floor and connected into the ventilation system through ducts. Such an arrangement of the coolers was not possible for this generator, owing to the limited space below the machine.

The arrangement used is shown in Figs. 2 and 6. The coolers are located above the floor and on either side of the generator, within a large sheet-iron housing, which also encloses the generator. The blowers are placed below the floor, two on either side of the generator and housed with their driving equipment in chambers directly beneath the coolers.

Each pair of blowers is coupled together and arranged to be driven normally by a single 200-hp. 1,440-r.p.m. induction motor, connected to the shaft of one of the pair of blowers. To insure that the ventilating air supply to the generator would not be interrupted by failure of the alternating-current power to the blower motors, a small single-stage steam turbine is also connected to each pair of blowers. The turbines are normally operated idling, and are automatically placed in service if the voltage to the motors fails. The four blowers fur-

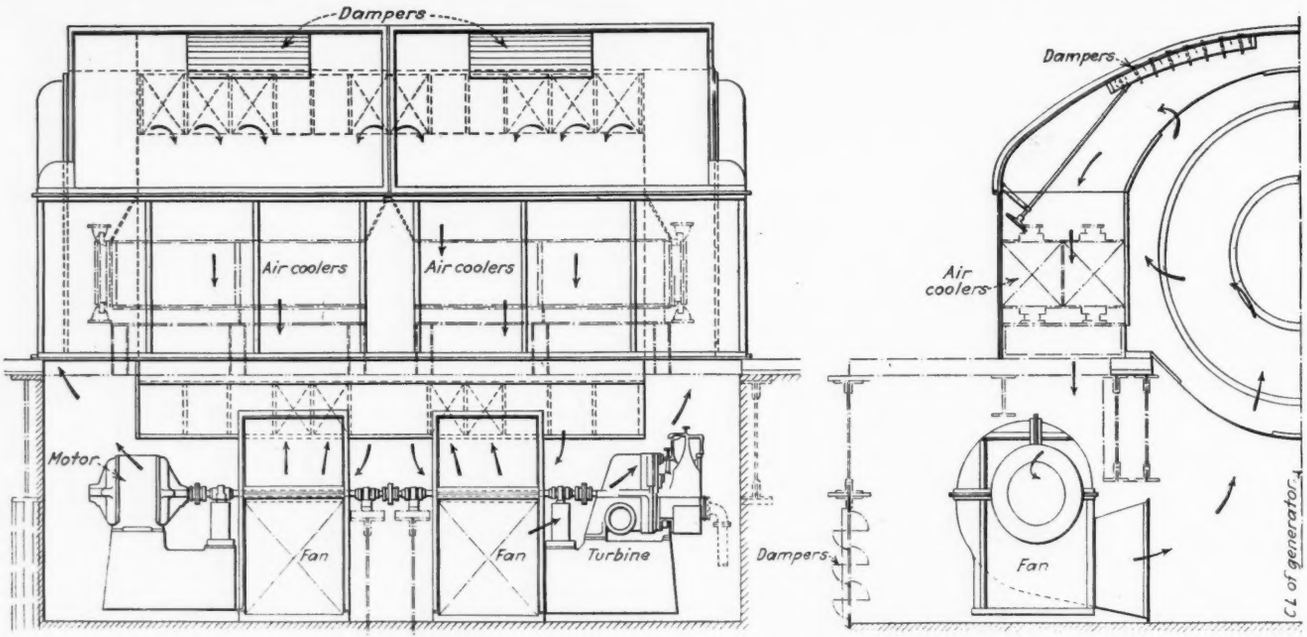


Fig. 6—Outline of the ventilating system, showing arrangement of blowers, air coolers and housings

There are two blowers on each side of the generator and are located below the coolers. Each pair of blowers is driven by a 200-hp. induction motor. On the opposite end of the shaft from the motor a steam turbine is coupled to the fans. Normally the turbines will operate idling and are automatically placed in service if the voltage at the motors' terminals fail. Although the generator will normally operate in a closed-circuit ventilating system, provisions have been made for readily changing to an open-circuit system, in the event of failure of the cooling-water supply or of the coolers themselves.

nish approximately 160,000 cu.ft. of air to the generator per minute, at a static pressure of 9 in. of water.

The arrangement of the ventilation system used with this generator has never before, so far as is known, been used in this country. It possesses several advantages over other arrangements that have been used, principally in simplicity, compactness and accessibility. The first two of these advantages are the reduction to a minimum of the duct work outside the generator, while an unusual degree of accessibility is gained by locating the coolers above the floor level. The necessary air passages for conveying the ventilating air to and away from the coolers are located within the ventilation housing. The duct work is reduced to a minimum by enclosing each pair of blowers with its driving equipment within a common chamber. Doors are provided at either end and on each side of the ventilation housing, which open into inactive air spaces at the ends of the coolers, thus permitting inspection or repairs to the coolers and their piping while the generator is in operation.

The paths of the ventilating air through the generator, blowers and coolers are indicated in Figs. 5 and 6. The four blowers discharge the cooling air into a common chamber, located directly beneath the generator, from which it flows upwards into the end bells and into annular chambers, the latter formed by the stator-frame plates surrounding the core. From the end bells the air passes into the air gap, and thence flows radially outward through the end sections of the stator core, through numerous small openings in the iron uniformly spaced around the circumference of the core and along its axis.

Rotor Air Cooled

Air also enters the rotor end windings and shaft body from the end bells, discharging through openings in the retaining rings and rotor body into the air gap. From the two annular intake chambers the cooling air passes radially inward through the stator core through numerous small openings in the iron uniformly distributed around and along the core, flows along the air gap in both directions, and then passes radially outward through the middle and end sections of the stator core. The air discharged from the core passes around its outside, n ducts formed between the annular frame plates, to openings at the top of the frame, from where it flows downward to the coolers in passages formed by the ventilation housing and the stator frame. From the coolers the air passes downward into the chambers containing the blowers.

The air coolers are arranged in four groups of two cooler sections each, two groups on each side of the generator. Raw salt water is used for the cooling medium.

Although it is intended that the generator shall normally be operated in a closed-circuit system of ventilation, provisions have been made for readily changing to an open-circuit system, should the cooling-water supply fail or trouble develop in the coolers. This has been done by providing dampers in the top of the ventilation housing and in the sides of the chambers containing the blowers, which, when turned to the open position, allow the ventilating air for the generator to be taken from the basement and to be discharged from the generator into the turbine room. The dampers are operated by means of hand wheels, conveniently located above the turbine room floor. The operating mechanism for the discharge dampers is placed within the ventilating housing, in the inactive air space between the front and rear groups of coolers, and is accessible through doors in the sides of the housing.

Electrical Features

Although the electrical parts of the machine have not been considered in this article they have many interesting features. As the output of the generator is about 8,000 amp., it is in excess of the capacity of a single switch and several such machines on a busbar with any of the customary arrangement of reactors could result in very large short-circuit currents. Keeping the machine's output within the limits of the station's equipment was solved by using two electrically independent stator windings which are brought to their individual oil switches and connected to separate busbar sections. With this arrangement the switches have to carry only about 4,000 amp., or one-half of the generator output, and at the same time the maximum short-circuit current is reduced.

The turbine driving the generator consists of an eighteen-stage high-pressure cylinder and a double-flow low-pressure cylinder of six stages. Steam is supplied at 375-lb. pressure and 725 deg. total temperature through two 18-in. diameter steam lines. Eight control valves are provided which give a flat steam-rate curve. At the best point the guaranteed steam consumption is 8.8 lb. per kilowatt-hour.

Exhaust from the high-pressure end discharges through two large diameter pipes to the low-pressure cylinder. Exhaust from the low-pressure end is condensed in a 90,000-sq.ft. single-pass condenser. Steam is bled from the 13th, 17th and 21st stages for heating feed water. Pictures on the following page show the turbine during installation.

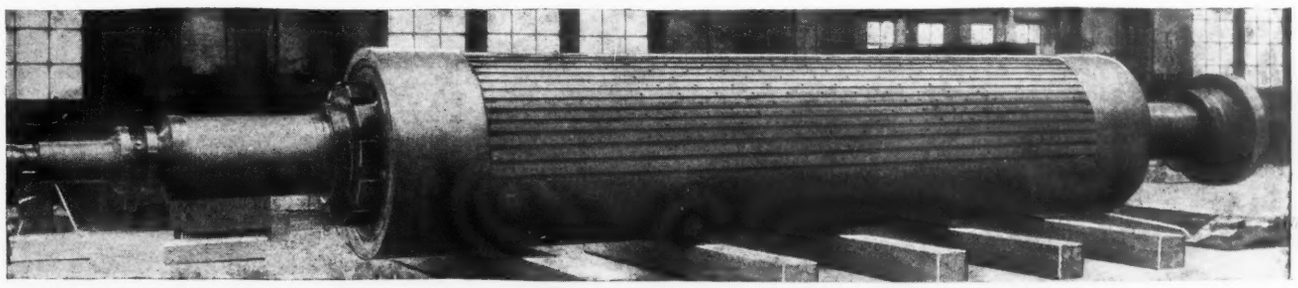
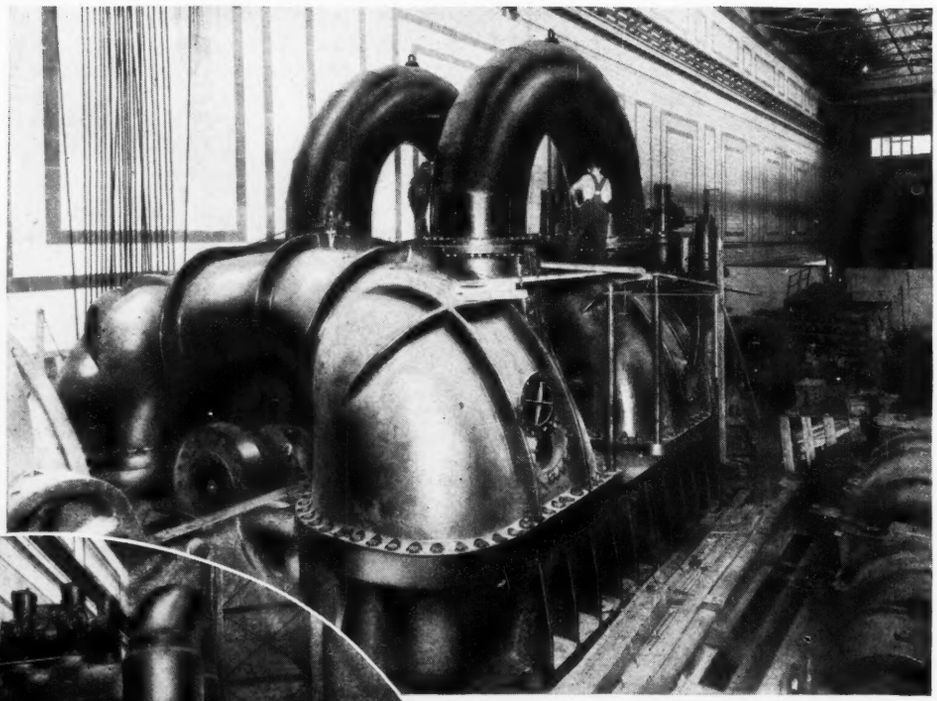


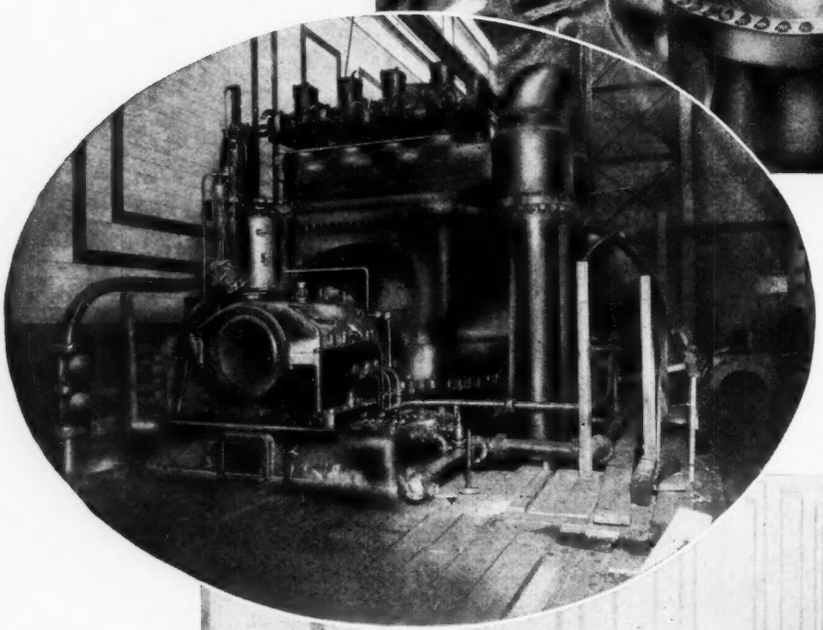
Fig. 7—The complete rotor with its windings weigh 262,000 pounds

The rotor core consists of three steel forgings, a hollow body section and two solid end pieces, all three being shrunk and bolted solidly together. Heavy steel rings are fitted over the end projections of the field windings, to hold them in place against centrifugal force. The body part of the rotor weighs 228,000 lb. and was the largest single forging ever produced by the steel mills.

Erecting Turbine Drive For World's Largest Generator

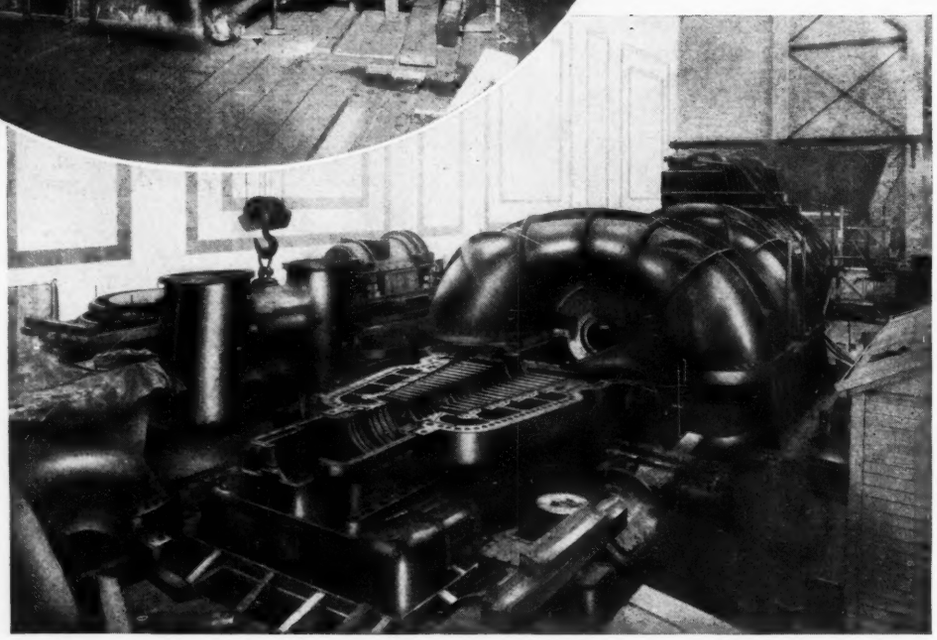


Below — The high-pressure end of the 160,000-kw. tandem-compound single-generator unit under construction at the 14th St. station of the New York Edison Company. Steam is supplied through two 18 in. diameter steam lines at 375 lb. pressure and 725 deg. temperature. Its over-all length is 86 ft. 8¾ inches



Above—Each cylinder of the double-flow low-pressure end has six stages. Steam is bled from the 13th, 17th, and 21st stages

Below — The high-pressure element has eighteen stages. At the best point the guaranteed steam rate is 8.8 lb. per kilowatt-hour



The Future of Higher Steam Pressures

By Irving E. Moultrop
Chief Engineer, Edison Electric Illuminating Company, Boston, Mass.

This abstract of a paper presented by Mr. Moultrop at the Great Lakes District Meeting of the A.I.E.E. in December urges lower construction costs without sacrifice of recent advances in efficiency. Mr. Moultrop points to the advantage of large high-pressure units and looks for a day when higher steam temperatures will make possible the economic use of much higher pressures.

WE HAVE so designed our stations that the fixed charges on the cost of construction are several times the combined cost of fuel, maintenance, and operating labor. It is, therefore, apparent that by attention to this fact we can make the largest saving in the cost of generating electrical energy. This problem undoubtedly takes precedence over all others before the industry today. What is the answer?

Some engineers have gone so far as to recommend that we forget our efforts for higher thermal efficiencies and build cheaper and less efficient generating stations. That is not a satisfactory answer.

What we should do is to maintain the higher efficiencies that have been obtained and at the same time reduce the cost of construction by more intensive study and better design.

Better engineering in the future is the answer to our problem.

We are doing better engineering today than in the past, because of the accumulated engineering data available, and because of the extensive research work of the past few years. Better engineering will result in more economical designs, more economical use of the materials of construction, more economical production, greater simplicity and ease of operation, and probably higher thermal efficiencies.

Old-Fashioned Stations Unprofitable

As a matter of fact, we are fortunately trapped by circumstances for our own good. We cannot afford to build stations today of the same design as those built a few years ago. A careful study will show that, if our fuel cost us nothing, we could not afford to build stations with as low thermal efficiencies as were built ten or fifteen years ago. No! The answer to the problem is not to take a backward step but to go forward. By better design we can maintain the high standards of efficiency and at the same time reduce the cost of construction and the fixed charge item in the cost of supplying electric service to our customers.

As electrical systems have grown in size, the capacity of the prime movers and generators has grown likewise. The use of larger turbine generator units, when intelligently used, has reduced the unit cost of generating stations irrespective of the operating pressure. However, it appears from the facts available at this time that the use of large turbine-generator units favors the higher pressure stations more than it does those designed for more moderate pressures. Today a 50,000-kw. unit for 1,200-lb. pressure costs somewhat more than one designed for 350-lb. pressure, but a 125,000-kw. unit costs about the same whether designed for 1,200- or 350-lb. pressure.

It would therefore appear advisable in high-pressure stations to install as large-sized turbine-generator units as practical from the operating standpoint. The recent designs of turbines that give practically the same economy over wide ranges of load have made it advisable today to use larger units than would have been advisable a few years ago for the same system load conditions.

Steam Units Smaller Than Generators

Interconnections of electric systems also permit the installation of larger turbine-generator units than would be advisable without interconnections. This factor should not be lost sight of, if the fullest advantages are to be obtained by interconnections.

In the past, the size of steam-generating units in our stations has always lagged behind the size of our turbine-generator units. From three to five boilers are often installed to serve one turbine-generator with a resultant large increase in the unit cost of our boiler plants when compared with a design in which the steam-generating unit matches the size of the turbine-generator unit.

There seems to be no basic reason why the steam-generating units should not match the turbine-generator units in reliability. Already steam-generating units have been operated with availability factors in excess of 90 per cent. If this performance can be matched consistently, there seems to be no reason why one steam-generating unit should not supply all of the steam for operating one turbine-generator unit. We can then have unit construction, one boiler feed pump, one boiler, one turbine, one condenser, one circulating water pump, and one auxiliary power supply. A reasonable number of cross-connections will insure continuity of service and will reduce the unit cost of spare equipment.

It is also true that this better balance between the size of steam-generating units and turbine-generator units is desirable irrespective of the operating pressure employed, but the accomplishment of the proper balance will make

a greater reduction in the unit cost of the high-pressure stations, because of the higher unit cost of high-pressure boiler plant equipment.

The argument of "the larger the unit, the lower the unit cost" carries throughout the station, for it applies to station structures, piping, and auxiliaries. It likewise applies to transmission lines, substations, and distribution systems right up to the customer's meters.- The basic reason for this is the fact that the larger units permit the most economical use of the materials of construction, labor and supervision.

Size Determines Cost

Construction experience has very definitely shown that the size of the unit has a great deal to do with the comparative cost between high-pressure and moderate-pressure installations. Undoubtedly a 5,000-kw. 1,200-lb. installation would cost more per kilowatt than one for 350 lb., while for much larger units there appears to be little, if any, difference in unit cost. This s undoubtedly the reason why comparative studies for small plants for industrials usually show that the normal pressure installation is the cheaper, all factors considered.

The recent A.S.M.E. Steam Table Research Committee's publication of the Total Heat Entropy Diagram extended to 3,500 lb. per sq.in. and 1,000 deg. F. total steam temperature has very clearly pointed out that for every steam temperature there is a theoretically economical pressure. The higher the temperature, the higher the economical pressure. For a temperature of 750 deg. F. and the regenerative reheat cycle, the economical pressure is in the neighborhood of 1,400 lb. per sq.in. In other words, the steam temperature is in reality the governing factor.

Already the Detroit Edison Company has decided to lead the way in an attempt to raise the operating steam temperature to 1,000 deg. F. It has purchased a turbine-generator to operate with steam at moderate pressure at this temperature for the new Delray Station.

As the difficulties with the higher temperatures are worked out, the higher temperatures will be combined with higher pressures and there is a possibility that we will be faced with the necessity of raising operating pressures even higher than 1,400 pounds.

Will Reheat Be Justified?

The development of equipment suitable for utilizing steam at 1,000 deg. F. will result in justifying the use of higher pressures without reheat, and who can say, that reheat, with 3,200 lb. per sq.in., will not be justified?

If the time comes when pressures considerably in excess of 1,400 lb. are justified, we must depart radically from our present design of boilers. We must abandon thermal circulation in boilers and water-cooled furnace walls and adopt forced circulation. Just because we cannot at once reconcile our minds to such a radical departure in design is no reason for our feeling that there is nothing in the idea before it has been given a thorough trial. Some European engineers believe that forced circulation is advisable for pressures as low as 1,500 pounds.

The European trend is distinctly toward higher steam temperatures at moderate pressures because the engineers over there believe that the unit cost of high-pressure equipment is too great to be justified by the fuel savings to be obtained by its use. On the other hand, in America the trend is just the other way; i.e., higher pressures at moderate temperatures. It is the opinion of American engineers that higher temperatures call for the use of alloy steels and the proper alloys are not available today at prices that make their use profitable.

There is no doubt that many engineers on both sides of the Atlantic are fully alive to the proper relation between pressures and temperatures, and one can find many instances where certain companies are going far ahead of the general trend. Two noteworthy examples of this are the Detroit Edison Company's purchase of 1,000-deg. F. equipment, and the recent purchase of a 300,000-lb. per hr., 3,200-lb. per sq.in. Benson boiler for the Langerbrugge Station in Belgium.

We have been told on many occasions that the laws of diminishing returns will preclude going much higher in pressures or temperatures, and yet both in America and Europe engineers are going ahead and accomplishing results with higher pressures and temperatures that may force a revision or a reinterpretation of the law of diminishing returns. It is indeed very dangerous to draw definite conclusions from trends; it is wiser to watch the accomplishments of the pioneers.

High Type of Engineering Called for in Modern Plant Design

The experience thus far gained in the construction and operation of high-pressure and high-temperature stations clearly indicates that the design and operation calls for engineering talent of the highest type. Designs and construction details must be worked out with the greatest care or otherwise the cost of construction will increase to a point where the fixed charges will offset the savings in fuel. On the other hand, if the proper skill is exercised, there does not appear to be any additional capital burden and the greater economy pays a handsome dividend on the effort expended. The argument that greater skill is required is no valid reason for refraining from using the most economical equipment any more than a merchant should refuse to enlarge his business for fear that the larger and more profitable business will require more careful planning and attention.

Construction experience has shown also that high-pressure stations need not be confined to base load operation. Since they can be built for practically the same unit cost as low-pressure stations, they impose no additional capital burden and can be justified for supplying the normal load of the system. This fact will undoubtedly greatly increase the use of higher pressures in the future, because it is seldom practical to operate a generating station as a base load station for a long period of years.

Testing a Flywheel

AN INSTRUMENT has been devised which enables one without constructing a model, to measure with accuracy and facility the strain within large metal structural parts such as girders, flywheel spokes, propeller shafts, etc., when they are "under load." The measurement of strain is made by measuring teh slight change of length between two points on the surface of the part under test when the strain or load is alternately applied and removed. The measurement of change of length is so sensitive that the makers of the instrument claim that .000005 inch shows up distinctly. This is the change in length of a ten-foot steel bar 1 inch in diameter when only 1 pound of compression or of tension is applied to its ends.—*Industrial Bulletin* of Arthur D. Little, Inc.

HEATING THE *Highest Building*

By LOUIS T. M. RALSTON
Consulting Engineer

THE new Chrysler Building, located at the corner of 42nd St. & Lexington Ave., New York City, is claimed to be the highest structure in the world. It is 75 stories high and 1,075 ft. from the basement to the top of the flagpole on the roof. The ground floor covers an area of 38,000 sq.ft., and the building contains a total volume of thirteen million cubic feet.

Steam for building heating, kitchens and water heating is purchased from the New York Steam Corporation. It enters the building at 130 lb. pressure through two 10-in. mains. All of the piping installed by the New York Steam Corporation is of welded construction, the first of its kind to be installed by this company.

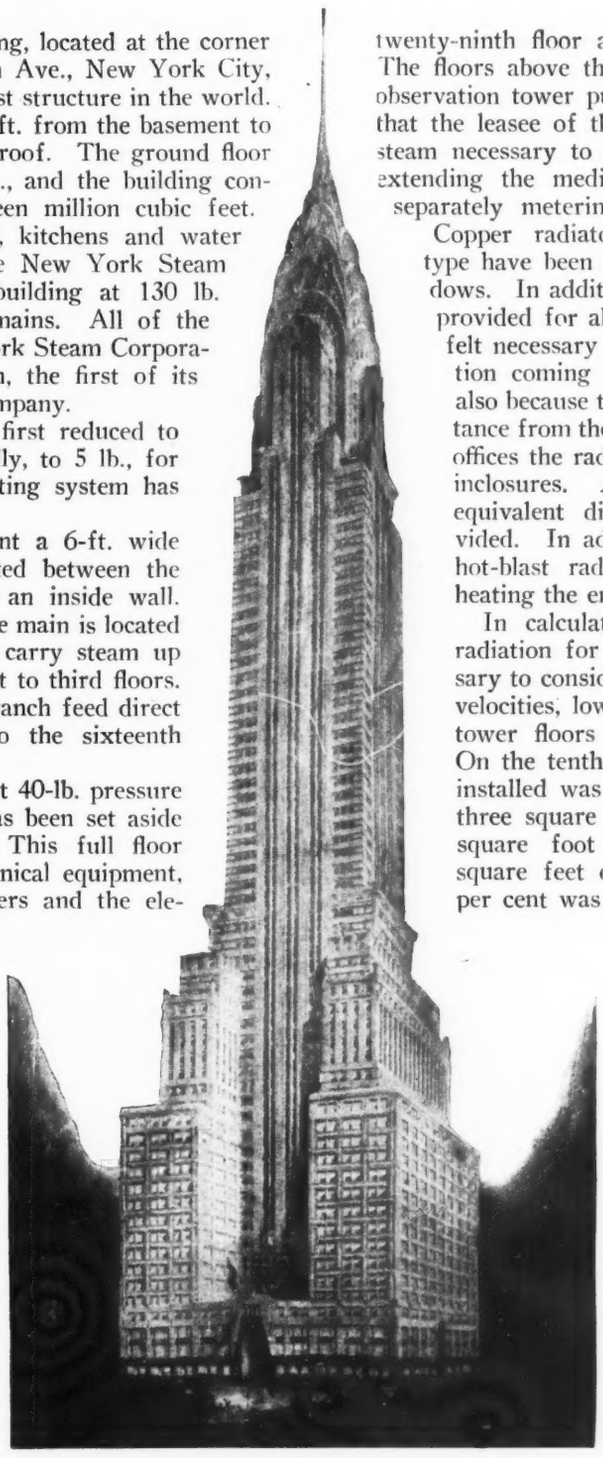
The high-pressure steam is first reduced to 80-lb. then to 40 lb. and, finally, to 5 lb., for which initial pressure the heating system has been designed.

In the building sub-basement a 6-ft. wide pipe space has been constructed between the building foundation wall and an inside wall. A branch from the low-pressure main is located in this pipe space, and risers carry steam up from it to radiators on the first to third floors. Other risers from this same branch feed direct radiation from the fourth to the sixteenth floors.

A 10-in. line carries steam at 40-lb. pressure to the thirtieth floor, which has been set aside as a full floor pipe space. This full floor space is used for other mechanical equipment, such as fans, hot water heaters and the elevator motor-generator sets.

A branch line from the medium-pressure riser delivers steam through a reducing valve to a low-pressure header in the pipe space. From this header steam is supplied for building heating through down comers to the seventeenth floor.

The medium-pressure riser is reduced to 8 in. diameter and continues from the thirtieth floor to the sixtieth floor, where it delivers steam to another full story pipe space. From a low-pressure steam header on this floor steam is distributed down to the twenty-ninth floor and up to the seventy-second. The floors above the seventy-second are used for observation tower purposes, and it was considered that the leasee of these floors should pay for the steam necessary to heat them. This necessitated extending the medium-pressure steam riser and separately metering the steam to these floors.



The Chrysler Building

Copper radiators of the extended surface type have been installed under all of the windows. In addition to this, radiators have been provided for all interior corridors. This was felt necessary to take care of the air infiltration coming from the elevator shafts, and also because the corridors are quite some distance from the outside of the building. In the offices the radiators are provided with metal inclosures. A total of 179,000 sq.ft. of equivalent direct radiation has been provided. In addition to this, 44,000 sq.ft. of hot-blast radiation has been installed for heating the entrance and basement floors.

In calculating the required amount of radiation for the upper floors it was necessary to consider the effect of increased wind velocities, lower outside temperatures at the tower floors and building chimney action. On the tenth floor the amount of radiation installed was based on one square foot for three square feet of glass surface and one square foot of radiation for every ten square feet of exposed wall. Twenty-five per cent was added to this for radiators on the north side of the building and fifteen per cent for radiators on the south side of the building. To take care of the building stack effect on this floor 20 per cent was added to the calculated radiation requirements. This percentage varies from 30 per cent on the lower floors to 10 per cent on the higher floors, and above the twentieth floor it has been omitted altogether. In the tower section the radiation has been calculated on the basis of a wind velocity of 25 miles per hour.

The returns from radiators above the sixtieth floor

are collected in the sixtieth floor pipe space and piped separately to the basement. Returns from the radiators between the thirtieth and sixtieth floors are collected in the thirtieth floor pipe space and also returned direct to the basement. Returns from the radiators between the thirtieth and seventeenth floors join the returns from the lower sixteen floors. Condensate meters separately record the returns from each of these sections.

Three vacuum pumps, consisting of one duplex unit and one single unit, handle the heating system returns. During severe weather it is expected that two pumps will be required to take care of the starting load, but that subsequently only one pump will have to be operated. The pumps are arranged so that any one of them can be used as a spare. The heating system condensate is pumped through water preheaters before being discharged to the sewer.

Each of the distributing headers in the various pipe spaces are divided into two sections, one covering the northwest exposure and the other covering the southeast exposure. Remote-control, air-operated valves distribute steam to these sections as conditions require. Twenty-eight thermometers arranged to give indications to the engineer's office are located inside the building, and also at 28 positions outside of the building. It is expected that these temperature indications will greatly aid the operation of the heating system and particularly it will tell the engineer when to turn steam on in the morning.

Other mechanical features of the building include 14 ventilating systems the duct work of which is all of galvanized copper bearing steel and alternating current supplied throughout the building with 13,000 volt feeders run to distributing centers on various floors. There are thirty-two passenger elevators. Those running to the tower are designed for a maximum speed of 1,000 ft. per minute.

This article was prepared from a talk by Mr. Ralston at a meeting of the New York Chapter of the American Society of Heating & Ventilating Engineers on Nov. 11.

German Power Production Gradually Coming Under State Control

Germany's great progress in the utilization of bituminous coal for the production of electric power is illustrated by the dimensions of the enlarged generating plant at Golpa, near Bitterfeld. This plant is stated to be the largest of its kind in the world, and especial pride is taken in the operation of two new generators, each of which has a capacity of 100,000 kw., whereas 75,000 kw. has hitherto been the maximum capacity of any generator hitherto employed in Germany.

The administration of the Golpa works points out, for comparative purposes, that the entire consumption of electric light and power by such a city as Breslau is supplied by five local works with a combined capacity of 70,000 kw. The requirements of electrical energy by the nitrogen works at Wittenberg and the immense Leuna Works of the Dye Trust are supplied from Golpa, and several 100-kw. cables convey current to Berlin, Leipzig, Magdeburg, and a number of small towns and villages. Altogether, Golpa has 440,000 kw. at the disposal of consumers. Only a few years ago it would have been considered impossible for such an immense amount of electric power to be produced from brown coal.

The generation of electricity in Germany is gradually being taken over by the state, the cities and the communes, and every year sees the acquisition of power plants by one or other public body. The scheme is to provide cheap power for large areas from several central works, and to prevent the consumer from being exploited by private companies. This project is being developed in a grandiose manner, as the following example will indicate: In 1921 the State Electricity Works, after acquiring all the shares of the Nieder-Lausitz Power Company, combined this with its works at Trattendorf, on the upper reaches of the River Spree. The enlarged Trattendorf works were drawn into the general scheme, and now form the eastern base for the supply of electrical current for the country reaching from the Hartz Mountains to Breslau. In 1919 Trattendorf had at its disposal a plant with a capacity of 20,000 kw. The present plant's capacity is 160,000 kw. The works have thus become the greatest in eastern Germany and the fourth largest in the whole of the Reich. As the State Electrical Works owns immense brown coal deposits in the Nieder-Lausitz, the development of the production of electrical energy will be continuous. Cheap power is supplied by Trattendorf to Berlin for the suburban lines of the Reichsbahn and for light and power in the Province of Saxony, the southeast Province of Brandenburg, and numbers of towns, villages, works, farms, etc.

American Loan Finances Extensions

The Vereinigte Elektricitats Werke Westfalen, which is chiefly owned by the municipality, but partly also by the central government, the State of Prussia, and the Province of Westphalia, uses Westphalian hard and soft coal. It has increased its sale of current this year by 20 per cent and will shortly augment it further, for it has just concluded agreements with several large industrial companies, including the Vereinigte Stahlwerke, for the sole supply of the electrical power needed. As in most other cases, these works are run as a separate company, the capital of which is at present 75,000,000 marks, but the extension of plant and the acquisition of fresh mines necessitates the raising of an additional sum of 50,000,000 marks. A loan of $50,000,000 was arranged some months ago from American financiers on a general mortgage. Of this an instalment of $20,000,000 has already been taken. It is proposed to take a further $10,000,000 from this loan to finance the necessary extensions.

The Rheinische-Westfalische Elektricitats Werke, formerly a private undertaking but now under the control of the state, the province, and numerous communes, has just published its balance sheet for the year 1928-29. The gross profits were 60,670,000 marks, as compared with 48,400,000 marks in the preceding year. The dividend has been increased from 9 to 10 per cent. These works obtain their supply from hard and soft coal. The value of their property has increased in three years from 250,000,000 marks to 463,100,000 marks, while the current supplied during 1928-29 showed an increase of nearly 50 per cent on the previous year. During the past year the works aided the development of the general scheme by the absorption of power stations in Trèves and Dettingen. At the same time parcels of shares in communal and private supply undertakings in various smaller places are being secured.

Hard coal, soft coal and peat are the sources of 75 per cent of the electric power produced in Germany, while 14 per cent is water power and about 10 per cent is gas-driven.

MILL *Reaps Benefits From* RECONSTRUCTION *of* BOILER PLANT

BY K. B. HOWELL
Industrial Engineer, Glen Ridge, N. J.

ABOUT eighteen months ago it became necessary to make alterations to the boiler plant of the Little Ferry Mill of the Flintkote Company, which makes roofing felt base for asphalt shingles and roofings. Previously the plant consisted of two 5,500-sq.ft. vertical water-tube boilers used as regular operating units, with three 1,500-sq.ft. horizontal return-tubular boilers for spare service. The operating units burned No. 2 buckwheat coal on chain-grate stockers, and the spare units were oil-fired. Normal operating steam pressure was 150 lb., which was reduced to 125 lb. when the spare units were in service.

The average load on the boiler plant was approximately 50,000 lb. of steam an hour, with peaks about 25 per cent above and below this average.

An unfortunate design in the initial construction of the vertical units prevented the attainment of boiler and furnace efficiencies in excess of about 62 per cent. The return-tubular units, while obtaining somewhat better efficiencies, were rather costly, owing to the price of oil fuel, and a handicap to operations resulted from the low steam pressure necessitated.

It was decided to install a new boiler of up-to-date design to act as the operating unit, retaining the vertical water-tube units for spare or emergency service and scrapping the older equipment. The retention of the vertical water-tube units necessitated maintaining the operating pressure not in excess of 180 lb., for which such units were originally designed. In making the new installation it was deemed desirable to make certain other changes to the boiler plant, including replacement of the existing steel stacks with a new brick chimney; also, installation of an air heater to permit use of preheated air under the boilers.

The combination of structural conditions and the ca-

Performance of Boiler Under Operating Conditions

Duration of test	**10 hours**
Proximate analysis of fuel	
Grade, No. 3 buckwheat Volatile matter, per cent..	5.62
Fixed carbon, per cent	71.07
Ash, per cent	14.39
Moisture (as fired) per cent	10.96
B.t.u. (as fired)	10,927
Operating Data	
Steam pressure, lb. gage	170
Temperature, deg. F.	465
Feed-water temperature	198
Temperature gas inlet to econ. sec.	954
Temp. gas leaving econ., deg. F.	367
Total fuel fired, lb.	52,400
Total water evaporated, lb.	409,505
Factor of evaporation	1.117
Total equiv. evap. per hr., lb.	45,741
Combustible in ash, per cent	30.33
Equiv. evap. per lb. of fuel as fired	8.73
Eff. boiler, furnace and grate	79.0

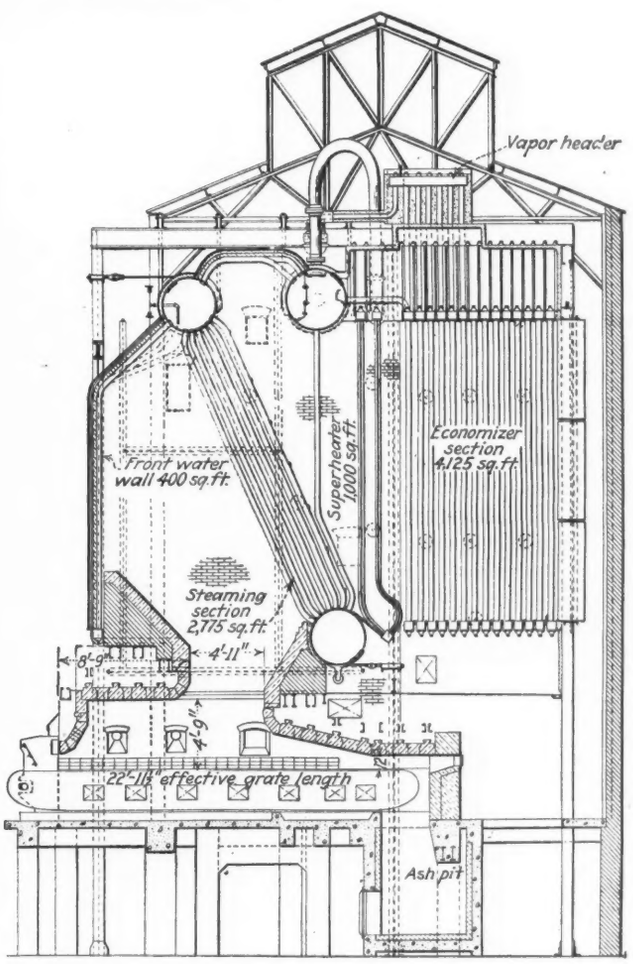


Fig. 1—Cross-section of boiler setting

pacity required limited somewhat the type and make of boiler to be selected, but within such limitations a survey was undertaken. The unit finally determined upon was an Edgemoor single-pass water-tube boiler, illustrated in Figs. 1 and 2. It is of the three-drum single-ring circulation type, with one 48- and two 42-in. drums. The steaming section contains 2,775 sq.ft. of heating surface. An economizer section of 4,125 sq.ft. heating surface at the rear of the steaming section is an integral part of the unit. The superheater has 1,000 sq.ft. of surface, and the front water wall 400 sq.ft. There are no side water walls. The combustion chamber is 9 ft. 10 in. in width, with an effective grate length of 22 ft. 11½ in. The boiler is equipped with eleven soot blower elements electrically operated and automatic in action. The pressure of a single push-button serves to start the soot blowers, which continue to operate in automatically controlled sequence until the blowing cycle is completed.

The fuel for the new unit, No. 3 buckweat, costs at the mill $3.45 per ton—about 50c. per ton less than the No. 2 buckwheat formerly used. It has a B.t.u. content of approximately 11,500. Firing was designed to employ a Harrington chain-grate stoker. A Hagan system of combustion control and a Sturtevant tubular-type air

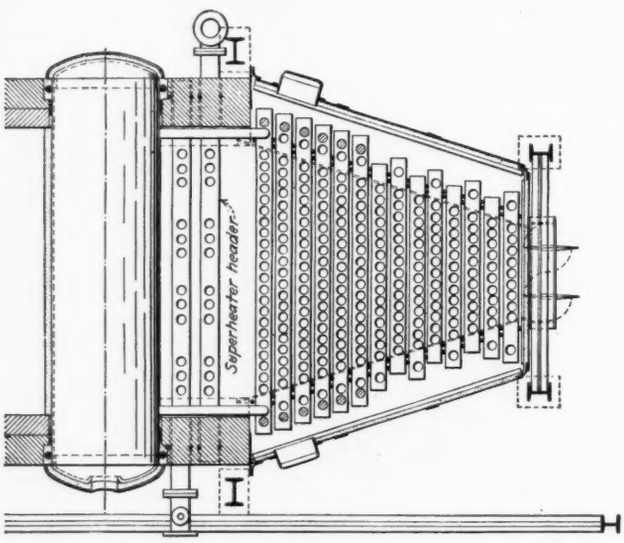


Fig. 2—Partial plan view of boiler and economizer section

heater were installed. The new brick chimney is 7 ft. in diameter and 175 ft. high.

At the time of initial installation of the unit there was a strong tendency on the part of furnace engineers to restrict the throat between the front and rear combustion arches, so the original throat was designed for a depth of 3 ft. 8½ in. Because of the carrying over of excessive fly ash the throat opening was later widened to 4 ft. 11 in. This corrected the condition.

The expected performance predicted by the manufacturer is shown in Fig. 3. After completion of the modifications to the throat design, a ten-hour test was conducted to determine compliance of performance with the guarantee. During the period of the test the load was allowed to fluctuate with plant requirements, but in all other respects the test was conducted in accordance with the standard A.S.M.E. code methods.

With due consideration of the nature of load conditions during the test and subsequent regular operating performance under non-test conditions, the boiler is regarded as having satisfactorily come up to expected performance. Monthly operating efficiencies in excess of 80 per cent have been regularly obtained.

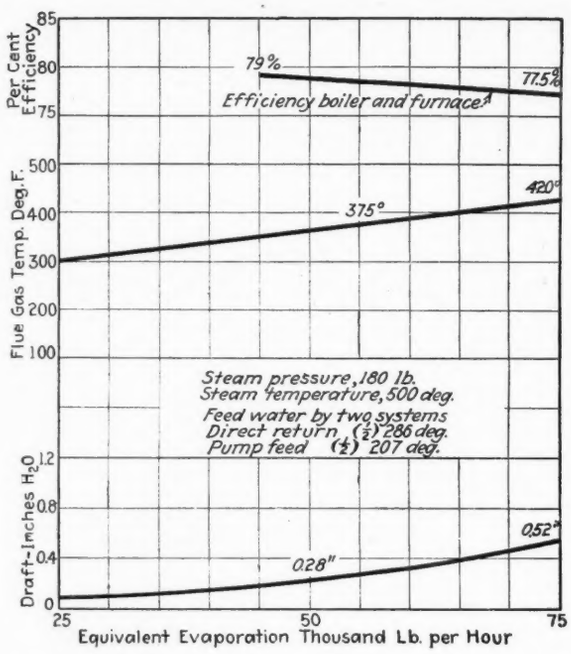


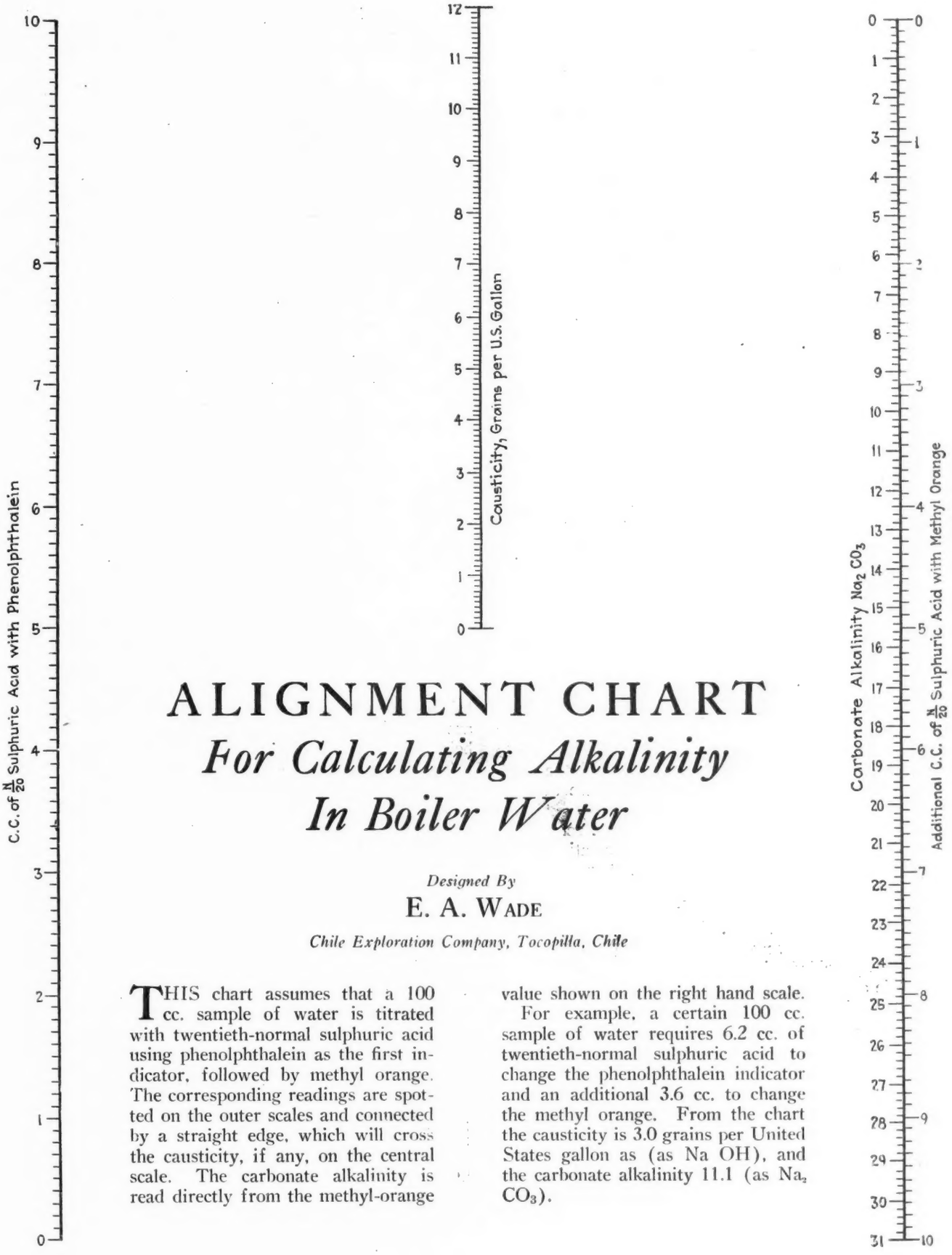
Fig. 3—Curves show performance predicted by boiler manufacturer

The economies effected at the plant through the operation of the new unit range between $80 and $100 a day. During its first year of operation (which included the period of initial adjustment) the savings amounted to $24,000. In addition, the new unit makes possible a new mill electrification and plant generation of power program now in process of completion.

Arapuni Spillway Water Unearths Prehistoric Forest

IN *Power* for Oct. 8 (page 565) mention was made of a difficult foundation problem overcome by engineers of the Public Works Department, New Zealand, at the hydro-electric plant at Arapuni, on the Waikato River. Between the period of completion and filling of the dam and start of delivery of power by the first unit, about 20 months, a large volume of water has been flowing over the spillway. This water cut out a new course for the river, unearthed a prehistoric forest and eroded more than 500 feet of horizontal and vertical rock formation, making a deep cut to within 1,100 feet of the spillway. It is feared that if this rapid rate of erosion continues, it will not be long before the cut reaches the spillway.

Work is now under way to stop or reduce the flow over the spillway by allowing the water to escape through the diversion tunnel, which served this purpose while the dam was being built, and divert the river to its old bed. Then the new watercourse below the spillway will be concreted and otherwise protected against erosion. When the four units are at work, late this year or early next year, little water will find its way over the spillway, except during flood periods. Even during these periods there will not be enough water to cause serious damage to the spillway, it is estimated.


C.C. of N/20 Sulphuric Acid with Phenolphthalein
Causticity, Grains per U.S. Gallon
Carbonate Alkalinity Na_2CO_3
Additional C.C. of N/20 Sulphuric Acid with Methyl Orange

ALIGNMENT CHART

For Calculating Alkalinity In Boiler Water

Designed By

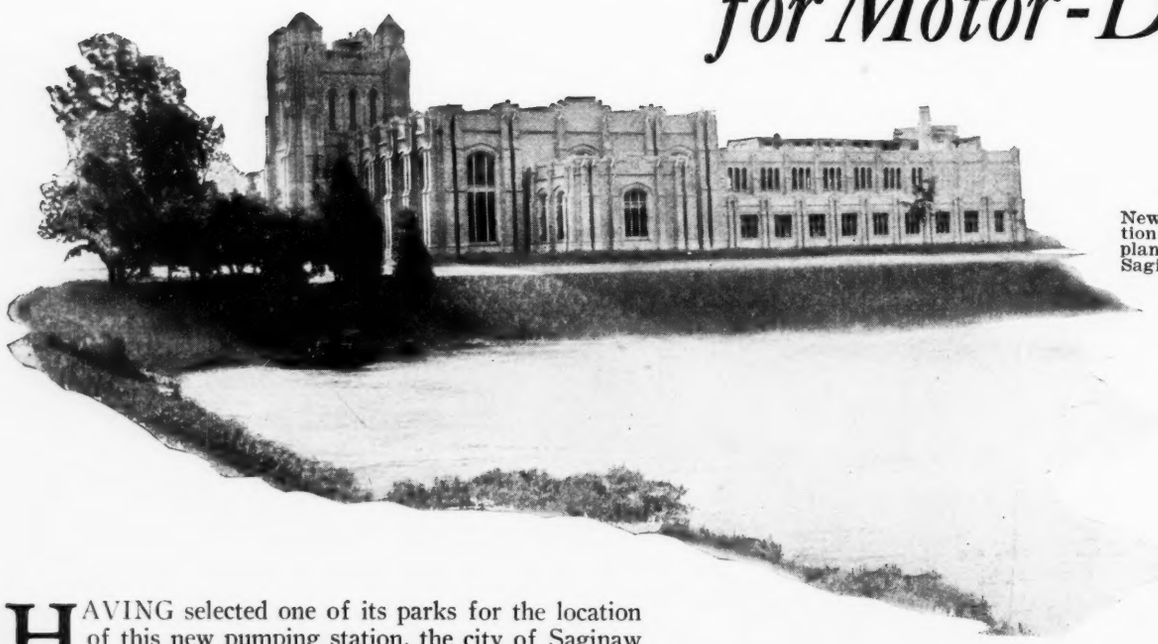
E. A. WADE

Chile Exploration Company, Tocopilla, Chile

THIS chart assumes that a 100 cc. sample of water is titrated with twentieth-normal sulphuric acid using phenolphthalein as the first indicator, followed by methyl orange. The corresponding readings are spotted on the outer scales and connected by a straight edge, which will cross the causticity, if any, on the central scale. The carbonate alkalinity is read directly from the methyl-orange value shown on the right hand scale.

For example, a certain 100 cc. sample of water requires 6.2 cc. of twentieth-normal sulphuric acid to change the phenolphthalein indicator and an additional 3.6 cc. to change the methyl orange. From the chart the causticity is 3.0 grains per United States gallon as (as Na OH), and the carbonate alkalinity 11.1 (as Na_2CO_3).

DIESEL ENGINES *for Motor-Driven*



New pumping station and filtration plant of the City of Saginaw, Mich.

HAVING selected one of its parks for the location of this new pumping station, the city of Saginaw required that the building and its equipment be in harmony with the surroundings. Some interesting problems of architectural and mechanical design were encountered. The exterior view of the plant gives an idea of how successfully the architect met the requirements.

A low power rate offered by the local electric company was responsible for the decision to use motor-driven centrifugal pumping equipment, with Diesel engine-driven generators as stand-by units. The pumping equipment consists of five low-service units that deliver water from Lake Linton, a bayou of the Saginaw River, to the mixing tanks in the chemical building; five high-service units that pump water from the clear water reservoirs into the mains; a wash water pump, used to fill the wash water tank; and a large drain pump. There are two Diesel-engine-driven generators.

A switch room, at one side of the engine room, provides space for truck-type oil switches, automatic starters for motors, motor-generator sets and a storage battery.

A screen room, on the side of the pumping station nearest Lake Linton, houses two motor-driven traveling screens, each 6 ft. 6 in. deep. Provision is made for the installation of a third screen when required. Each screen chamber is provided with a sluice gate on the inlet and outlet side of the screen, affording complete access to the entire screen if required. Water is supplied from a house line to wash the screens, and sewer connections are provided to take care of this wash water and whatever dirt passes through the trash baskets. A 10-ton geared hand-power traveling crane serves the screens.

The low-service pumps are driven by squirrel-cage motors operated from a control panel by automatic starters. Under ordinary conditions it is necessary to prime these pumps before starting. This is accomplished through a vacuum line extending to two motor-driven vacuum pumps. The remote control for the operation of the vacuum pumps is mounted on the same panel with the remote control of the pumps themselves.

Water for the water seal glands of the pumps is provided from a house line, thus affording clean water for this purpose. Valves on the suction and discharge piping are hand-operated, all valves larger than 20 in. diameter being geared.

The high-service pumps are driven by synchronous motors, also operated through automatic starters from a control panel. Direct-current field excitation for these motors, which range in size from 200 to 500 hp., is provided by motor-generator sets. Ordinarily, these pumps do not require priming, but to be prepared for contingencies, connections to the vacuum pumps have been made.

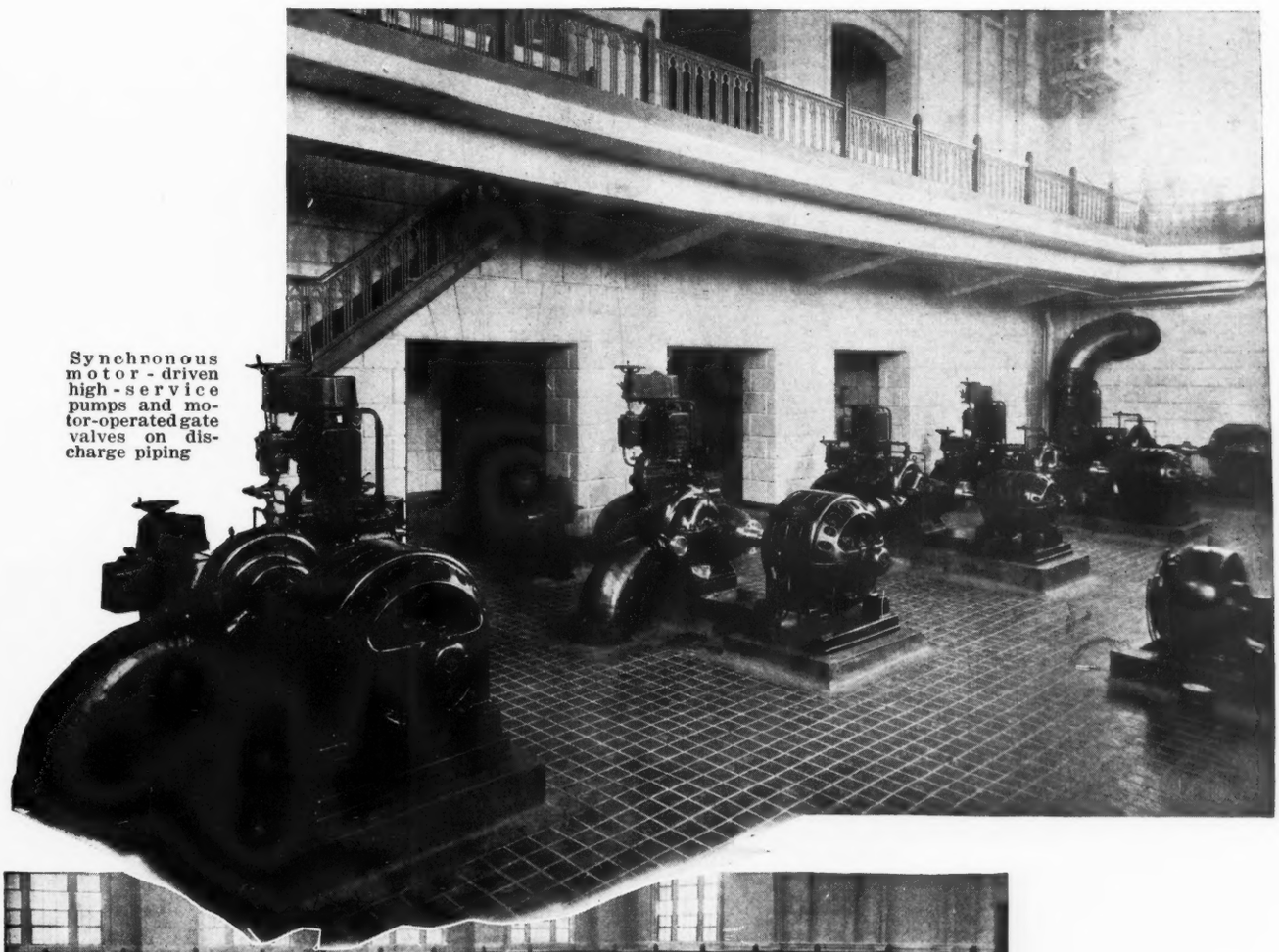
All valves on the individual discharges and on the discharge loop header are motor-operated. The valve control panel is a part of the control switchboard and on it the push-button controls are located on a miniature piping diagram. This miniature piping layout duplicates exactly that of the discharge piping, all locations being indicated. Each push-button control is at a spot on the miniature pipe diagram corresponding to the actual location in the distribution piping of the valve it controls. "Open," "closed" and "intermediate" lights indicate the exact position of all valves at all times. The electrically operated valves

Diesel engines as a source of reserve power, motor-driven centrifugal pumps, truck-type oil switches, motor-operated valves, traveling screens and emergency lighting from a storage battery are the outstanding features of this new pumping station and filtration plant.

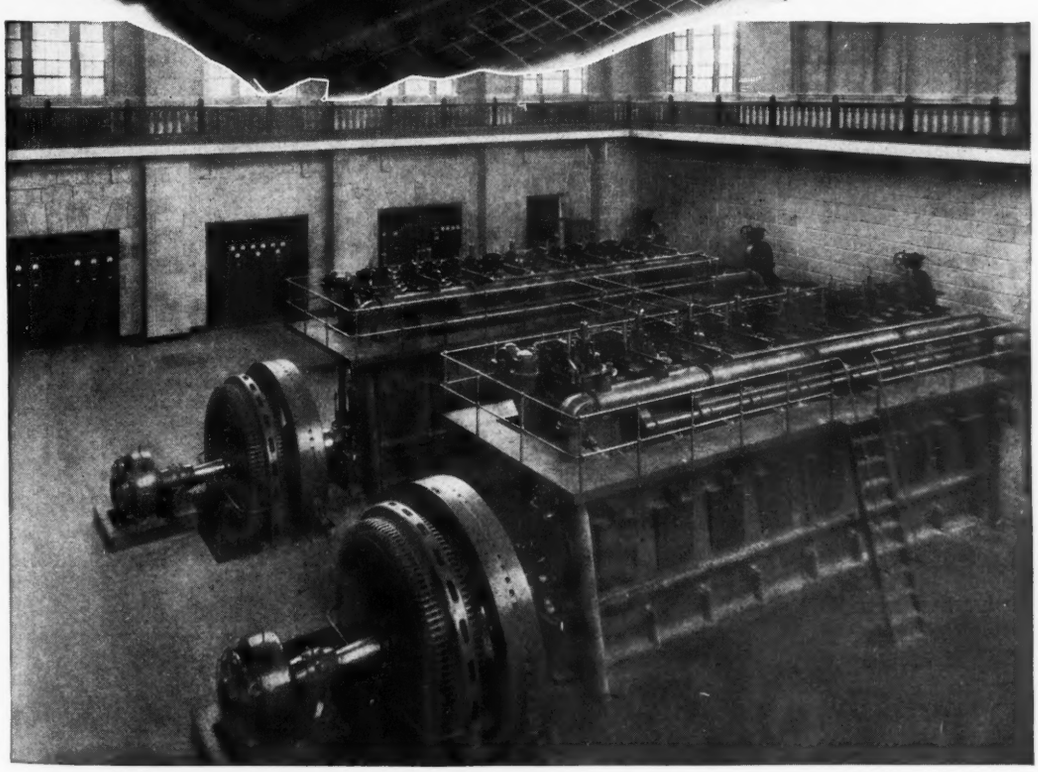
PROVIDE STAND-BY

Pumping Station

By F. G. Gordon
Gordon & Bulot
Consulting Engineers
Chicago



Synchronous motor-driven high-service pumps and motor-operated gate valves on discharge piping



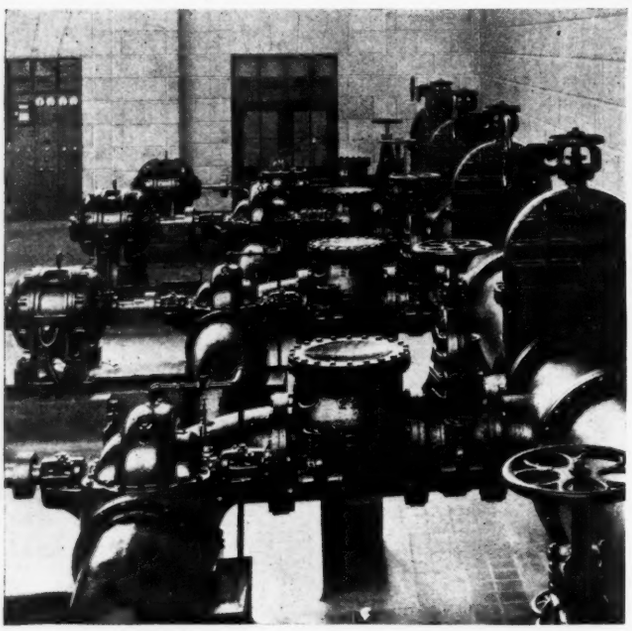
Two Fulton Diesel engines installed as stand-by power result in a low fire insurance rate.

Summary of Equipment in Pumping Station

Pumping equipment.....De Laval Steam Turbine Co.

No. of Pumps	Capacity	Head	Motors		Overall Eff. Per Cent
2	8,400	175	Synchronous	Elec. Mach. Co.	80.4
1	5,600	175	Synchronous		80.3
1	3,600	175	Synchronous		78.9
1	3,200	175	Synchronous		76.2
2	8,750	34	Squirrel-cage	Westinghouse	74.8
1	7,280	34	Squirrel-cage		73.5
1	5,810	34	Squirrel-cage		72.9
1	4,375	34	Squirrel-cage		72.8
1	8,400	30	Squirrel-cage		74.7
1	4,200	68	Squirrel-cage		74.0

Diesel engines, two, 875-b-hp., four-cycle, trunk-piston, air-injection, eight-cylinder, 200-r.p.m., Fulton Iron Works Co.
Generators, two, 671-kva.....Electric Mach. Mfg. Co.
Mufflers.....Maxim Silencer Co.
Pyrometers.....Brown Instrument Co.
Oil gages.....Bristol Co.
Pumps, fuel oil, two, 35-g.p.m..Blackmer Rotary Pump Co.
Crane, hand-operated, 10-ton..Detroit Hoist & Machine Co.
Crane, elec. operated, 10-ton..Manning, Maxwell & Moore
Traveling screens, 6½ ft. wide, chamber 35½ ft. deep.....Chain Belt Co.
Sump pumps, two, 300-g.p.m., 32-ft. head, American Well Works
Vacuum pumps, two, 80-c.f.m., 18-in. vac., Nash Engineering Co.
Elevator, freight, 3,000 lb.....Warner Elevator Mfg. Co.
Motor-generator sets, two, 15-kw., Westinghouse Elec. & Mfg. Co.
Control panels.....Westinghouse Elec. & Mfg. Co.
Oil switches, truck-type....Westinghouse Elec. & Mfg. Co.
Motor starters.....Sundh Electric Co.
Storage battery, 15-amp. for 2 hr., 75-amp. for 10 min.....Westinghouse Elec. & Mfg. Co.
Valves, motor-operated.....Chapman Valve Mfg. Co.



Low-service pumps driven by squirrel-cage motors

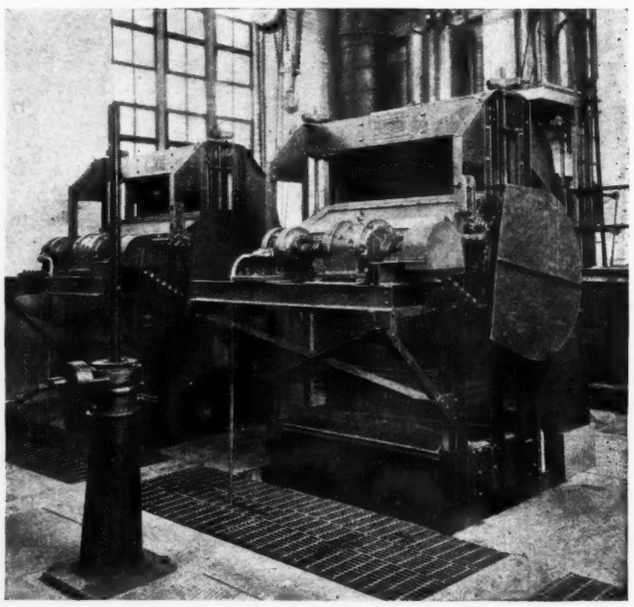
are provided with a declutching arrangement that permits hand-operation if desired.

The two Diesel engines are of the four-stroke-cycle, air-injection, eight-cylinder, trunk-piston type, running at 200 r.p.m. and rated at 875 b.hp. Each engine is directly connected to a 671-kva. generator with an exciter on the outboard end of the generator shaft. Because of the architectural requirements of the building, it was necessary to make a detailed study of the most suitable location for the engine exhaust pipes. It was decided finally to carry these pipes to the top of the tower, which is one of the outstanding architectural features of the building. This disposition of the exhaust piping required extremely long runs of pipe, the length from the most distant engine being 220 ft. Individual exhaust pipes 14 in. in diameter were used for each engine. In the base of the tower a silencer was installed on each exhaust pipe. Operation of the silencer has been entirely satisfactory, as no back pressure exists at the engines, and the noise of the exhausts when the engines are fully loaded cannot be heard at the ground level.

Fuel oil is stored in an underground circular concrete tank having a capacity of 125,000 gal. Motor-driven fuel-oil pumps, in a sump at the storage reservoir, pump this oil to the small supply tanks in the screen room. The large oil storage tank is supplied with radiator coils placed near the suction of the fuel pumps.

A 10-ton motor-operated crane serves the mechanical equipment in the engine room. An electric freight elevator serves the basement, engine room and balcony floor levels.

A gage board between the two engines contains a pyrometer for ascertaining exhaust temperatures from each of the cylinders of both engines, seven-day recording



Traveling screen room

oil-level gages showing the oil level in each storage tank, and switches controlling the operation of the fuel-oil pumps. Certain of the lights in front of the control board, on the Diesel engines, and throughout the building are operated by the storage battery, so that in case of failure of power, the station will not be in darkness.

It is customary to keep on the Diesel engine's bus one of the high-service pumps that is not operating. In the event of a failure of electric power, this pump is ready to operate as soon as one of the Diesel-engine units has been started.

The consulting engineers on the work were Maury & Gordon, now Gordon & Bulot, of Chicago; and Hoad, Decker, Shoecraft & Drury, of Ann Arbor. J. G. Jordan, electrical engineer, assisted Maury & Gordon in the preparation of plans for the portion of the plant described in this article. V. A. Matteson, of Chicago, was the architect. The entire project from its inception was under the general direction and detailed supervision of construction of Herman H. Eymer, city engineer.

Something *to Make* YOU *THINK*

Many boilers are operating under load conditions that do not justify the heat efficiency for which the plant was designed. If coal can be purchased for $3.50 a ton, it is uneconomical to build an 85 per cent efficient boiler plant when a 75 per cent plant can be obtained for 50 per cent less first cost.

Is high efficiency worth the *price?*

By Theodore Maynz
Consulting Engineer

THE question engineers are asked to answer is—Are industrial power plants wrong in blindly following the central station, in installing highly efficient boilers with their heavy overhead charges when the load conditions are such that advantage cannot be taken of the boiler's possibilities?

In their early history there was no difference between the industrial and central station power plants. Both types had similar boiler rooms, consisting of a multitude of hand-fired horizontal return-tubular boilers. The engine room held non-condensing engines, slide-valve or corliss type, direct-current three-wire generators, knife switches mounted on slate panels, duplex piston pumps and injectors. The firemen and the engineers were more noted for their strength than for their intelligence.

With the advent of alternating current and water-tube boilers, the central station started to grow and improve, both in equipment and men. By 1910 the central stations had discarded, or were discarding, their corliss engines, which had grown to have a capacity of 7,500 kw., in favor of turbines of from 10,000 to as high as 15,000 kw., with surface instead of jet or barometic condensers. The multiple-retort underfeed stoker was just starting to be used in the East, the chain-grate in the West and Middle West. Feed-water heaters, economizers and superheaters were being installed; coal and ashes were being handled by conveyors of one type or another, instead of by hand labor; and the reciprocating feed pump was losing ground.

Though the central station was producing a kilowatt-hour on about 2½ lb. of coal, the industrial plant, even of large capacity, was lagging far behind. Practically none had anything but return-tubular fire-tube boilers, hand-fired, and engine generators, the less modern ones still using slide-valve engines, non-condensing—all generating direct current. The use of direct current was imperative, due to the lack of variable-speed alternating-current motors.

When trying to sell modern equipment, such as stokers, turbines, or water-tube boilers, to the industrial plant of 1910 to 1915, if one mentioned the fact that the central stations were using this equipment, the frequent objection was "They can afford to, they are big, and that is their business." It was in this era that the business of the central station public utility made its most rapid growth in rate of increase, selling power to many an industry that on account of its process and heating steam requirements could have made its power at a much lower cost than it could be purchased, had the management been foresighted enough to learn the more modern methods of power generation.

During the war boom of 1915-1920 many industrials were forced to build new power plants, or increase and modernize their old ones. Stokers and boilers were sold "over the counter"; generating equipment could not be manufactured fast enough, and the advent of the variable-speed alternating-current motor allowed the use of generators at from 440 to even 2,300 volts, while switching apparatus changed from knife switches to oil circuit breakers.

At the present time the modern large industrial power plant is blindly following the lead of the public utility, even though very often there is no economic need for the super-power type of equipment that is being purchased. In many cases excellent technical engineering is very poor financial engineering, so the cost of the power plant equipment is by far too large for the work that is being done.

Many a boiler unit is operating under load conditions that do not justify the heat efficiency for which it was designed. When the cost of power is only 10 to 15 per cent of the cost of the factory's finished product, and coal can be purchased for $3.50 per ton, it is uneconomical to build an 85 per cent efficient boiler unit, when a 75 per cent unit can be built for a cost of from 5 to 50 per cent less. As an example, a 10,000-sq.ft. boiler unit, complete with stoker, fans, brickwork, superheater, steam main, feed- and blow-off piping, but exclusive of stack, pumps and coal-handling equipment, can be installed for about $75,000. Such a unit operating at 200 per cent rating for 7,000 hr. per year will produce about 450,000,000 lb. of steam at an efficiency of 75 per cent, consuming 23,100 tons of $3.50 coal, at a cost of $80,850 per year. A similar unit, operating at 85 per cent efficiency will consume 20,400 tons, costing $71,400, per year. The saving is 2,700 tons of coal, or $9,450, per year. The more highly efficient unit, with its heat-saving equipment, will cost about $50,000 more. With fixed charges at 15 per cent, it costs $7,500 per year in fixed charges to save $9,450, which is certainly a most unattractive investment.

As few industrial plants can figure on operating a boiler unit at an average rating of 200 per cent for 7,000 hr. per year, the lower load factor produces an even less attractive investment return. There are several central stations that have been built recently to use $3.50 coal whose super-efficiency cannot be justified on a coal costing less than $5 per ton.

However, there are a few cases where the super-efficient steam-generating unit is justified. Many times an industrial or central station has a demand for increased steam capacity without the available space. High rates of combustion and steaming must be maintained, involving water-cooled furnace, preheaters, economizers and induced draft. When this type of equipment is required, the cost of such refinements can be charged to the lack of space. Naturally, this increased amount of steam capacity is less costly than the initial installation, and thus can earn a dividend.

The difference in cost per unit of heat saving between extra boiler-heating surface and water walls, between dump-grate stokers and clinker-grinder stokers, between air preheaters and natural draft and cold air, between economizers and extra boiler tubes, is nearly always too large to earn an attractive return for the industrial plant on the usual load factor and coal cost.

There are refinements that are always justified in a power plant, large or small, industrial or public utility. The use of efficient boiler instruments, a good automatic control, oxygen-free feed water, automatic soot blowers and adequate heat insulation for pipe lines, fittings, heaters and drum heads, is almost as necessary for a power plant, small or large, as is the building to house the equipment.

Unless the plant consists of a couple of cast-iron heating boilers, or one small h.r.t. boiler supplying heating steam for only six months per year, the refinements mentioned will pay for their cost in a short time. In the same manner, an intelligent, well-paid operating crew will save more money than the difference in wages earned above the minimum for the job.

The answer to the entire problem of power-plant design is to use only such equipment as is suitable for the work to be done and for the coal that is available; and to be careful that the accessories will more than earn their way.

A Welding Thought Flys Home With Chickens

IN AN editorial written some months ago *Power* showed that "welding progress is backed by research" and that this is a primary reason for the rapid progress of this new art.

Quoting extensively from the editorial, the December number of *Oxy-Acetylene Tips* adds an example well worth bringing back to the pages of *Power*.

"Undoubtedly," says the editor of *Oxy-Acetylene Tips*, "the individual welder, hearing and reading so much discussion concerning research, frequently wonders just how it affects him and his daily work. An endless variety of examples could be cited, but one will perhaps suffice to illustrate the direct help that research can give to every welder.

"For some time standard steel pipe has been maintained within certain definite limits as to chemical composition and tensile strength. Using the welding rods available, welders have found no difficulty in producing welds that were consistently stronger than the pipe. Recently there has been a tendency toward the development of pipe with increased carbon content and higher tensile strength.

"If the welder were confined to the use of the previously available welding rods, all his skill and experience would be of little avail against the new conditions, and he would face the possibility of seeing his welds become the weakest part of the line instead of the strongest.

"But the research laboratories in the welding industry have anticipated what would happen and have already developed new welding rods that will give welds having even higher strength than the new pipe metal. Armed with these, the welder can face the new conditions with complete assurance of success. Research has enabled him to keep pace with industrial development."

Battersea Power Station a Great Engineering Work

ACCORDING to statements by W. A. Pearman, general manager, and Dr. S. L. Pierce, engineer-in-chief of the London Power Company, the new Battersea Station will be one of the principal stations in the South-East of England Electricity Scheme. Further, according to the Electricity Commissioners' tables it will be responsible for the major part of the energy required for that district, which stretches from Peterborough to Brighton and from Reading to the East Coast.

The site on which the station is being built covers fifteen acres; it has a frontage of seven hundred feet to the river, and siding communications with the Great Western and Southern Railways. It will have the largest boilers, the largest turbines, and the highest steam temperature of any station in the country. Another important feature will be the new switch gear, where a voltage of 66,000 is to be standard.

The company will own its own fleet of special colliers, and sea-borne coal in cargoes up to 1,800 or 2,000 tons will be brought alongside a jetty which is to be built out in the river, and will be discharged mechanically on to a system of conveyors, which will deliver them into the bunkers or into store. There will be a storage capacity of 70,000 tons, and later on further storage room will be available on another site down the river.

Right Out of the Plant

Why Some Boilers Explode

A LOCAL engineer who does some boiler repair work had an experience some time ago which illustrates how easily an inspector may overlook the real condition of a boiler if it looks all right on the outside.

The boiler was a locomotive type located in a school building. Some one had apparently burned waste paper or rubbish in it after it had been drained in the spring. When it was filled again previously to firing up in the fall at least half of the 56 tubes and the fusible plug leaked. The engineer was called in. He rolled the flues at the fire-box end, then filled the boiler with water.

It had been inspected in the spring and the certificate showed it was considered safe for 15 lb. pressure at that time, but when the water pressure built up to 12 lb. several tubes pulled out of the fire-box end tube sheet and nearly every tube leaked a stream. Some of the tubes were so badly corroded that they broke of their own weight when one end was cut loose. The scale and rust were all that was holding the pressure, and the heat from the burning rubbish had loosened that.

Butte, Mont. A. D. FORD.

What About Furnace Volume?

WITH reference to the article by W. L. Kent in the Oct. 15 number, entitled "What About Furnace Volume?" I should like to record that in the case of powdered-coal-fired boilers, a simple and reliable empiric formula for calculating the volume of the combustion chamber can be given.

It is well known that the capacity of a boiler, or the amount of steam produced, is a direct function of the amount of heat liberated in its combustion chamber. On the other hand, this amount of heat is a direct function of the furnace volume, and, vice versa, the furnace volume is a direct function of the amount of heat, or the number of B.t.u. liberated inside. Hence it is evident that both the boiler capacity and the furnace volume have a certain mutual relation.

If V is the volume of the combustion chamber in cubic feet,

C = the capacity of boiler in pounds of steam per hour,

H = the heating surface of boiler in square feet,

L = the evaporation per square foot of heating surface in pounds per hour;

then, $V = f(C) = f(HL) = eHL$, where e is an empiric number, equal to $0.111 = \frac{1}{9}$. Consequently, the required formula is $V = \frac{1}{9} HL$ and $L = \frac{9V}{H}$.

These formulas are valid for an efficiency of 80 per cent, which is the ratio of the amount of heat actually utilized by the boiler in comparison with the total amount of heat in the fuel used. They also give results consistent with present-day practice.

For example: (1) What is the volume of the combustion chamber of a powdered-coal-fired boiler of 20,000 sq.ft. of heating surface and an evaporation of 7 lb.of steam per square foot of heating surface an hour?

Answer: $V = \frac{1}{9} HL = \frac{20{,}000 \times 7}{9} = 15{,}555$ cu.ft.

(2) What is the normal load that can be attributed to a boiler of 22,500 sq.ft. of heating surface in a case when, owing to local circumstances, the combustion chamber cannot be made larger than 14,375 cu.ft.?

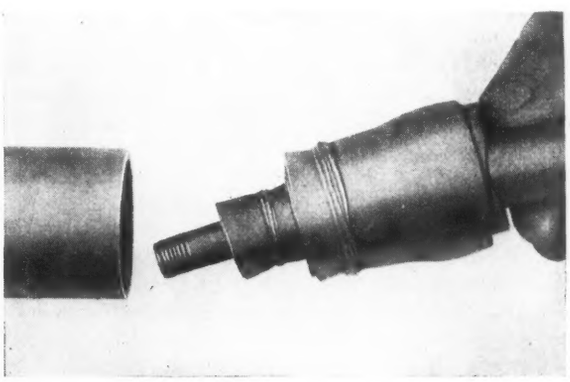
Answer: $L = \frac{9V}{H} = \frac{9 \times 14{,}375}{22{,}500} = 5.75$ lb.

Leningrad, U.S.S.R. W. HURST.

Neat Method of Packing Hose End

A SMALL air hose or one carrying low-pressure steam is often used for blowing soot, dirt, and other foreign matter out of larger pipes. Wrapping or packing the smaller hose end with waste, rags, or burlap is the usual method of confining the pressure and preventing its blowing back. Such methods are not always handy, satisfactory or safe.

A method of closing the opening around the hose that has proved satisfactory is to take a piece of an automobile inner tube and cut off a strip about an inch wide and 12 or 14 in. long, and wrap it tightly around the hose three or four inches from the end. Then cut off another strip about 3½ in. wide and the length of the first piece, and wrap it around the hose and the first wrapping. This gives a solid conical mass of tough rubber around the hose end. The front end of it will just enter the pipe, and as it is pressed in will come to the back portion, which, being larger, will completely and tightly close the opening. Tie the rubber strips securely with heavy cord or wire, which will hold and keep both pieces in place. This is a simple and practical way to pack the hose end and is much safer than the makeshifts generally used for this purpose.

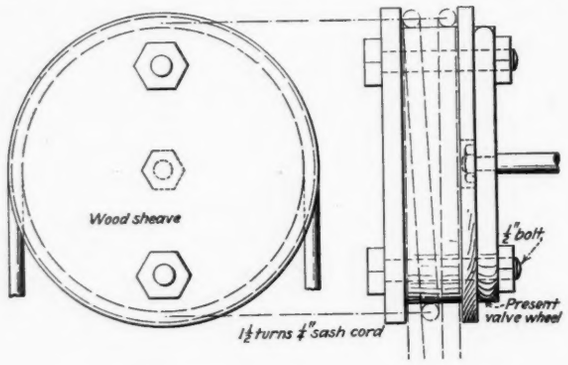


Tapered form of rubber packing on hose closes end of pipe

Missouri Valley, Iowa. FRANK W. BENTLEY, JR.

Operating Overhead Valves From the Floor

IN MOST plants there are certain small valves that must be opened or closed frequently or the opening through the valve has to be changed many times during the course of a day. Frequently these valves cannot be reached from the floor, and a ladder must be used. The method of extending the stem by means of a long rod with a forked end to fit into the handwheel is quite



Operating sheave attached to valve wheel

common, but the stem of the valve cannot always be made to point downward or at an angle so that this method can be used.

The illustration shows another way of doing this where the valves are placed with the stem horizontal. A wooden sheave is bolted to the handwheel of the valve, and sash cord is wrapped around the sheave and extended to within reaching distance of the operating floor.

Chicago, Ill. B. MEYERS.

An Experience With a Water Softener

THE article by George Cawley in the Nov. 5 number of *Power* recalls a little trouble we ran into recently with a zeolite water softener. Our water is supplied from driven wells. During the summer we cleaned fourteen old wells and also added six new wells to the system. These wells are approximately 50 ft. deep, with the water about 20 ft. from the surface of the ground. The well casings are 2½-in. extra-heavy pipe and the mains 4-in. standard pipe. The bottom of the wells tends to fill up with fines and rust. This slows down the flow, and one well became stopped completely.

When a well becomes stopped in this way we use a chisel-shaped tool attached to the end of a length of pipe and work it up and down on the accumulation. Water under pressure is forced from holes in the end of the tool while it is being worked up and down. This loosens the accumulation which is pumped out. It generally takes from two to four days per well to do this work.

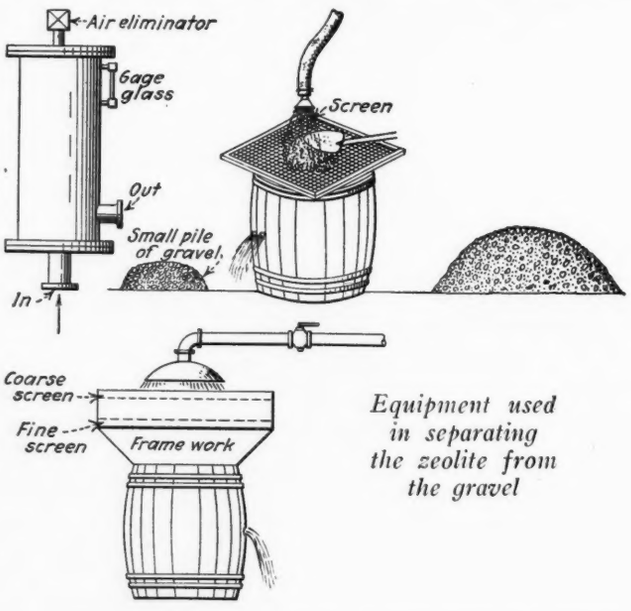
Although each well is disconnected from the main before cleaning, considerable air is drawn into the main while it is being disconnected and reconnected. Some time ago while disconnecting one of the wells large bubbles of air found their way into the header and into the softeners while they were being backwashed. These air bubbles blew the gravel bed against the sides of the tank, letting the zeolite down on the strainer system.

The remedy was to remove the zeolite, being careful not to mix gravel with it. We built a staging alongside of the tank, then used a scoop to remove all we could reach. We used a long-handled shovel to pull a great deal of it into a position where it could be reached with the scoop. The zeolite was simply thrown into a pile on the floor. After removing as much zeolite as we could without having any gravel mixed with it, we took pails and removed the remaining gravel and zeolite.

When the tank was empty we gave it a thorough cleaning. We also inspected the strainer system for loose strainers, but none was found. The gravel was then screened, first through ¼-in. mesh to remove the large gravel, then through fly screening to separate the fine gravel from the zeolite. When the screening was completed the coarse gravel was placed in the tank, followed by the fine gravel and the zeolite.

The softener was then closed up, thoroughly backwashed and a triple charge of salt run into it and allowed to remain all night. In the morning this was rinsed and the softener put back on the line.

In case some reader might be interested in how we washed the zeolite from the gravel, I will review the process briefly. We made two screens, 4 ft. long x 2 ft. wide. One was covered with ¼-in. mesh only and was used to separate the coarse gravel, while the other was covered with ¼-in. mesh screening and fly screening, the ¼-in. mesh being to relieve the fly screen from carrying any weight. The screens were placed on top of a barrel in which were bored three holes on a horizontal axis about the middle of the barrel. An improvised nozzle was attached to the end of a hose and water was directed onto the screen. One man threw the gravel on the screen and one shook and unloaded it. The coarse screen was used first and the water washed the fine gravel and zeolite into the barrel, the water overflowing through the holes in the side. When the mixture reached the level of the holes the barrel was dumped. After the coarse was all recovered it was placed in the tank and the



Equipment used in separating the zeolite from the gravel

fine screen used to separate the zeolite from the remaining gravel. It required about eight hours to screen 20 cubic feet.

If we had the job to do over again, we would pipe up a spray and build a framework to hold two screens, as shown in the lower view of the illustration. As a precaution, we are installing an air eliminator to guard against any recurrence of the above trouble.

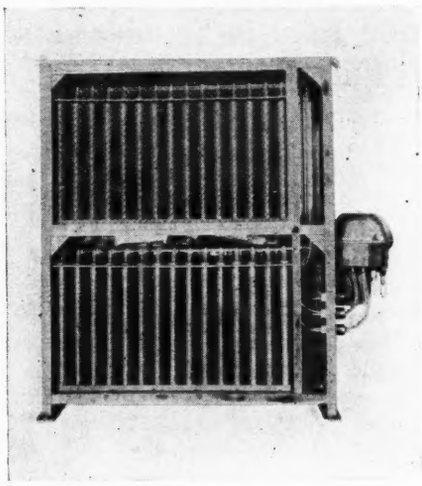
Watertown, Mass. T. A. WALSH.

What's New in Plant Equipment

HOW THE MANUFACTURER CONTRIBUTES TO THE JOB OF GENERATING TRANSMITTING AND APPLYING THE POWER SERVICES

Improved Cell-Type Capacitor

TO MEET the increasing demand for power factor corrective devices, the Electric Machinery Manufacturing Company, Minneapolis, Minn., has developed an improved line of cell-type capacitors suitable for standard voltages and frequencies, and for use on single-, two- or three-phase circuits.



A 360-kva., 2,300-volt, 3-phase, 60-cycle cell-type capacitor for indoor use. One screen is removed to show construction

A complete unit, each cell contains nine capacitor rolls. The desired capacity is obtained by connecting the required number of cells in parallel. The individual units are wound in cylindrical form, with interleaving layers of tissue and aluminum foil. After treating and impregnating, the rolls are rigidly mounted on a supporting rack and sealed under oil in a welded sheet-steel cell. The rack mounting of the rolls prevents any undue mechanical pressure on the paper and allows free circulation of the oil. Each roll is provided with a cutout, so that the injury of a unit roll will not interrupt the operation of the capacitor.

Stands of welded steel angle and T-bars form the supporting structure for the cells. For indoor service the sides of the stands are covered with screens; while for outdoor service, the complete unit including the switch is enclosed in a sheet-steel housing.

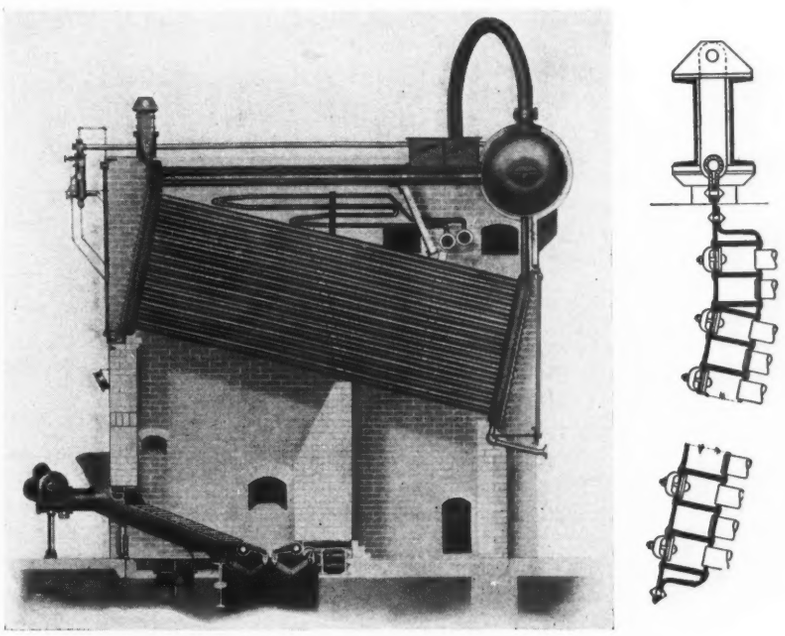
Three frame styles are used, depending upon the rating of the unit. Capacitors rated at 30 kva., and over, are mounted in double-deck stands. For capacities under 30 kva., a single-deck frame is used. Individual cell-type capacitors for small induction motor correction are also available.

New Cross-Drum Boiler With Single-Seam Headers

A NEW departure in boiler header construction is embodied in the design of the cross-drum boiler recently announced by the Erie City Iron Works, Erie, Pa.

Headers are of the box type, with a single seam. The tube sheet is press formed to provide water space in the header, while the handhole sheet is flat, the two being riveted together around the outer edge. With this construction the wrapper sheet is eliminated and it is possible to drive all the rivets hydraulically, which insures a better joint. An additional advantage of this construction is that all the rivets are out of the fire or hot-gas zone. Suspending the front header as shown permits all rivets in the hanger to be out of the water or steam spaces. This is made possible by extending the handhole sheet above the top row of rivets. The rear header is straight, while the front one is bent slightly to permit the two upper horizontal circulating tubes from the drum to enter at right angles to the sheet. Space between the top of the tube tank and the horizontal circulators is sufficient to accommodate a single- or multiple-loop superheater.

As shown in the section, the boiler is normally baffled for three passes and can be arranged for a vertical gas exit directly in front of the drum, or for a horizontal exit through the rear circulating tubes below the drum, as best suits installation requirements. The boiler has been designed to provide a wide range of sizes to meet low-head room conditions and to utilize any standard firing method. The smaller capacity units are supplied completely assembled, while in the larger ones the drum is put in position and connected to the tube bank, in the field.

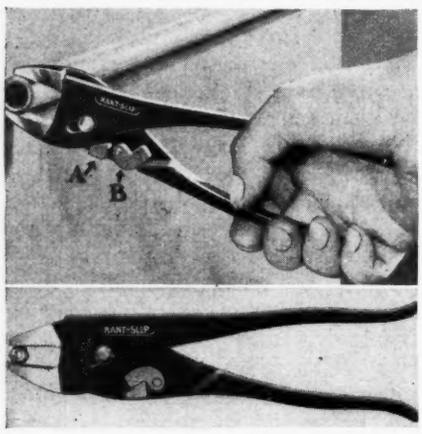


Cross-drum boiler with single-seam headers, also detail of front header suspension

New Pliers With Sliding Fulcrum

A NEW type of pliers, designated the "Kant Slip," recently announced by the Kant Slip Plier & Tool Company, 6036 Wentworth Ave., Chicago, is illustrated.

A claim made for the new plier is that there is no strain on the pin, it serving merely to hold the two members together. Referring to the illustration, the cam *A* slides the fulcrum, which is the corner of the upper jaw, to its correct position irrespective of the duty. This sliding action of the cam and fulcrum combine to positively wedge the work between the jaws, making the tool



Pliers adaptable to a wide range of work

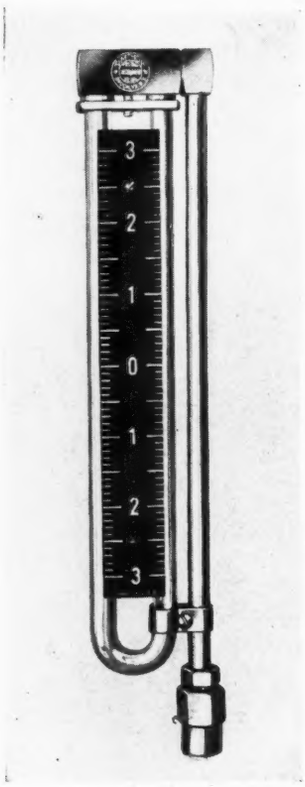
hold round work as readily as irregular shapes. To make it suitable for an unusually wide range of sizes, the movable cam *B* is added. This cam when turned around to rest on cam *A* assists in giving a parallel grip on small work. The tool is drop-forged from a special alloy chrome-vanadium steel and hardened.

Improved U-Gage for Static Pressures

AN IMPROVED method of packing whereby the U-tube is easily replaced in case of breakage, with cementing eliminated, is a feature of the improved U-gage announced by the Amthor Testing Instrument Company, Inc., 309 Johnson St., Brooklyn, N. Y.

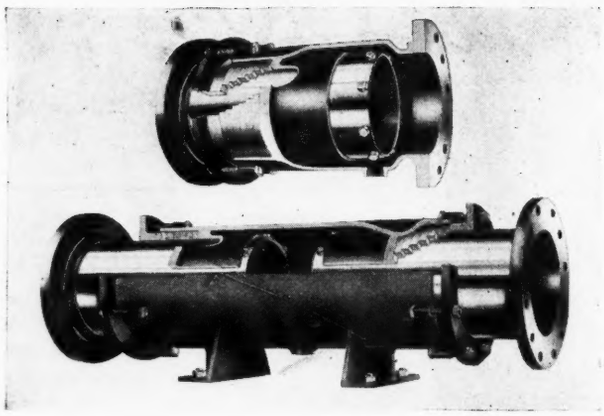
The gage is of the conventional double-reading type, with the indicated pressure the sum of the two scale readings coinciding with the water levels in the two legs. The scale, which is graduated in inches and tenths of an inch, with the zero line in the center, is readily adjusted to the zero water level. It has a black background with distinct white figures. The U-tube is made of annealed glass and all metal parts are polished nickel plate.

The pressure-tight connection between the U-tube and the head piece is made by a cross plate compressing the two packings simultaneously, the pressure being exerted by a single screw in the head piece. The gage, which is suitable for measuring static pressure in ventilating systems, gas lines, forced draft, etc., is made in nine sizes, ranging from 4 to 36 inches.



Six-inch U-gage

Single- and double-type cylinder-guided expansion joint



Cylinder-Guided Expansion Joint in Standard and Extra-Heavy Patterns

MADE in standard and extra-heavy designs, suitable for use with saturated and superheated steam and hot liquids, the improved cylinder-guided expansion joint now being put out by the Yarnall-Waring Company, 102 East Mermaid Lane, Chestnut Hill, Philadelphia, Pa., is made in the single and double types. It is also made with service outlets and special bases to suit requirements.

A feature of the joint is the use of a steam-jacketed cylinder guide integral with the body. This design, in addition to insuring perfect alignment, precludes the possibility of unequal expansion of the cylinder. The sliding sleeve end permits a closer fit between these two than would otherwise be possible. The sleeve is well above the inside bottom, giving sufficient space above the drain to take care of any accumulation of dirt. The sleeve is chromium-plated to prevent rusting or other corrosive action. It has internal limit stops and an unusually deep stuffing box and gland that is easily accessible for adjustment or repacking. The single-ended unit, as shown in the upper view of the illustration, is made with or without supporting base and with 4, 8 and 12 in. traverse. The double-ended unit, shown in the lower view, is fitted with supporting base and designed for the same traverse on each end.

The joint is available in sizes from $\frac{3}{4}$ to 24 in. in standard and extra-heavy patterns. Joints from $\frac{3}{4}$ to $2\frac{1}{2}$ in. are of all-brass construction, with screw ends and screwed gland with gland follower. All sizes between $2\frac{1}{2}$ and 24 in. are of steel.

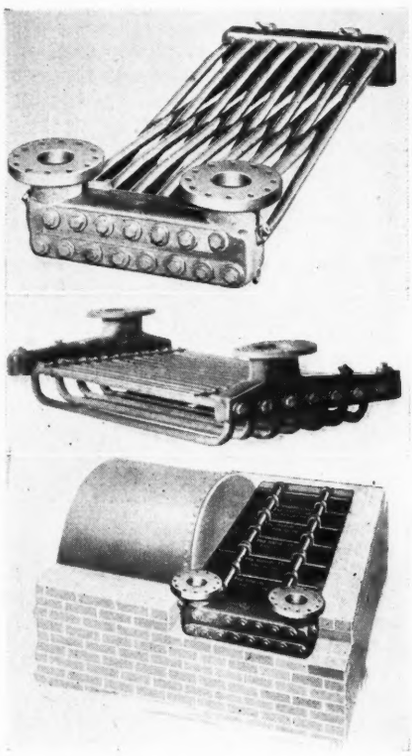
Improved Superheaters for Return-Tubular Boilers

AN improved line of superheaters available in two types and designed especially for installation in a horizontal position at the rear of a return-tubular boiler is now being offered by the Marley Company, Kansas City, Mo.

In the type *B* unit, shown in upper view of the illustration, the tubes are almost straight, being rolled into opposite headers and criss-crossed with slight offset to provide for expansion and contraction. In this unit the inlet and outlet steam connections are at the same end. In the type *C* unit the tubes are arranged so that the steam makes three passes; coming in at one header and out at the opposite one. This unit has more heating surface than the type *B* and makes possible a higher total steam temperature.

All units are provided with cast-iron cover plates supported from above and resting upon the headers. There are also removable screwed plugs at each end of every tube, and drain and safety valve connections are also provided.

The general installation arrangement is shown in the lower view.



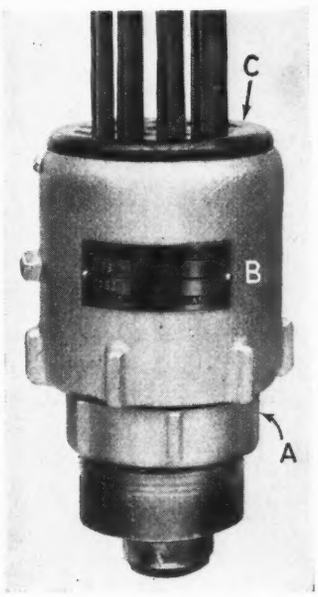
Type B and C units, also typical installation

The superheater replaces the regular rear arch but is elevated above the top row of tubes and the fusible plug, where one is used. It is placed free of the tube sheet, the space between the inner tube and the sheet being closed with the cover plates and insulation.

600-Volt Cable Terminators

A NEW "cable terminator" for sealing the ends of low-voltage lead-covered cables where they come out of conduits is announced by the Delta-Star Electric Company, Chicago, Ill.

The terminator consists of three parts: a lower adapter *A* screwing on to the conduit, a center coupling *B* and a top insulating cover *C*. The coupling member has an internal flanged tip which compresses the belled out lead sheath between it and the bottom adapter, insuring a tight joint. The lower adapter secures an effective ground connection between the lead sheath and terminator. After filling with compound, the top insulating cover is sealed in position.

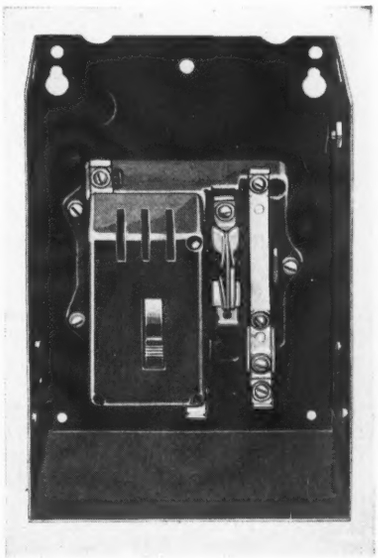


Terminator mounted on conduit and conductors brought out through insulating cover

Terminators are made for all standard sizes of conduit and for either single- or multiple-conductor cable. They can also be furnished for mounting directly on the cable without conduit. They are applicable for underground construction and for installations where moisture prevails, such as in ice plants, pumping stations, chemical plants, oil refineries and similar locations.

Meter Service Breaker Replaces Fuses

THE problems of sealed main fuses, accessible fuses, interlocking doors and other undesirable features of service switches are claimed to be solved by the meter service breaker illustrated, introduced by the Square D Company, Detroit, Mich.



Open view of the breaker

Some of the features of the breaker are front manual operation, which enables the breaker to be banked more closely and recessed; quick make-and-break, which banishes contact burning and variable action; front operating handle fully insulated and shock-proof. The handle indicates the "on," and "off" and "tripped" positions and can be locked or sealed in the "off" position. It is toggle-operated and can be reset as easily as an ordinary toggle switch can be operated. Since there is no need to have access to the circuit-breaking mechanism, it is sealed inside an insulating cover, to protect it against tampering and to keep out dirt when it is being installed. The breaker is furnished with the proper setting and nothing can be done to alter its performance.

Arrangement is made for ordinary meter trims and for banking troughs, there being a special bolt for locking the meter trims in place. It has a longer time element than fuses, withstands temporary overloads, but opens the line before any damage can be done and fast enough to protect rubber-covered wire, under all overload conditions. It is made for 30-amp., 125-volt, 2-wire solid-neutral service.

FROM AMONG READERS' PROBLEMS

Conducted by L. H. MORRISON

SUPERHEATED STEAM IN PUMP—*We have a crank-and-flywheel and a direct-acting steam pump in our waterworks plant. After installing new boilers carrying 200 lb. pressure and 75 deg. F., we find that while the crank-and-flywheel pump operates satisfactorily, the direct-acting pump groans, will hardly run and requires large amounts of lubricating oil. What is the cause?* A.D.A.

The difficulty is solely due to the pump principles. The crank-and-flywheel pump operates as an ordinary steam engine, and has cutoff and expansion. The steam upon expansion experiences a decrease in pressure and temperature, so that by the time the exhaust valves open, the steam is wet. Part of this moisture settles on the cylinder walls, where it forms an emulsion with the lubricating oil. This enables the oil to stick on the walls and lubricate the piston on the next stroke.

With the direct-action pump, no expansion occurs and the steam pressure and temperature is constant during the entire power stroke. The lubricating oil then fails to stay in the cylinder walls unless large quantities are used. The dryness of the cylinder walls accounts for the groaning. A compounded oil, with 5 per cent lard, might improve the action.

LOSS DUE TO COMBUSTIBLE IN THE ASH—*What is the formula for the loss due to combustible in the furnace ashes?* C.C.

The usual formula is

$$L = 14{,}600 \times \frac{AC}{(1-C)} \text{ when}$$

L = loss in B.t.u.
A = ash content per lb. of fuel
C = carbon content of the refuse

ALIGNMENT OF PUMP—*Why is it necessary to employ a flexible coupling for direct connection of a motor and a centrifugal pump if both are mounted on the same baseplate?* B.F.K.

It is difficult to set the center of a centrifugal or other machine in true alignment with the center line of a motor, and still more difficult to maintain that alignment on account of difference in wear of the bearings. Hence, to obtain good running conditions when direct-connected, it is necessary to connect the motor to its load with some form of adjustable coupling.

In the case of centrifugal pumps handling water at high temperatures and pressures, the expansion of the case may throw the shaft out of alignment with the motor shaft, if the bottom of the pump case rests on feet on the subbase. For this reason such pumps usually are supported by side bracket on the same horizontal plane with the shaft.

RESETTING VALVES TO CHANGE FROM CONDENSING TO NON-CONDENSING—*What changes should be made in the valve setting of a corliss engine if a change is made from running condensing to non-condensing?* A. H.

When running non-condensing the exhaust will be at higher pressure, and for smooth running of the engine the necessary cushioning on the exhaust can be obtained by less compression, obtained by closing the exhaust valves later in the stroke. On a single-eccentric engine, set the eccentric back on the shaft so that only the necessary compression of exhaust is obtained, and see that the exhaust-valve rods are short enough to obtain release before the end of the expansion stroks. Setting the eccentric backward will delay admission and the steam-valve rods will need to be shortened so the valves will have less lap and proper lead. With the wristplate hooked in gear, place the engine first on one center and then on the other and adjust the valve rods to suitable lengths for obtaining the proper lead and release. With a double-eccentric engine, setting of the steam eccentric and steam-valve gear needs to be no different than when running condensing, and for less compression of the exhaust, the exhaust eccentric and exhaust-valve gear would require the same attention as the valve gear of a single-eccentric engine, but omitting all consideration of the steam valves and their rods.

A Question for Our Readers

WE wish to use a 300-hp. Diesel and have it burn the same oil as we use under our boilers, namely 18 to 22 deg. Beaume which will work out best, an air-injection or a mechanical-injection Diesel? J. R. B.

Suitable answers from readers will be paid for and published in the Jan. 28, 1930, issue.

REMOVING A LEAKY RIVET—*On one of our boilers a rivet persists in leaking even though it has been calked several times. What should be done?* I.P.

The rivet should be removed and a new one put in. To remove it, the rivet should be centered and drilled to the depth of the head. A cross cut should then be made through the center with a cape chisel and the remainder of the head removed by breaking inward the remaining sections. The shank should then be drilled and driven out by a backing-out tool. The hole should be made smooth before the new rivet is inserted.

COMPRESSOR VALVES—*Our air compressor has corliss-intake valves; but now when we are on the market for a compressor, every builder seems to offer machines with automatic-intake valves. Are the latter better?* P.J.

For the air to enter the cylinder through an automatic valve requires a pressure difference, resulting in a loss in volumetric efficiency. On the other hand, the mechanically operated valve admits air with an insignificant pressure drop, but this type does not function well at anything but slow speed. When compressor speeds go over 100 r.p.m., the automatic valve is best.

CORRECTING POWER FACTOR WITH STATIC CONDENSERS—*We have a 120-kva. static condenser on our power load during the daytime. This load totals about 1,800 kw.-hr. for the day period, and the power factor is about 0.90 lagging. At night the load totals about 500 kw.-hr. We have not been using the static condenser on this load and the power factor is about 0.70 lagging. If the condenser is put into service on the night load the power factor is about 0.70 leading. Will it pay to operate the condenser on the night load? I have been told that a low leading power factor is as objectionable as a low lagging power factor. Why should this be so?* G.M.P.

The effects of a low leading power factor will depend upon conditions. On a feeder operating at 0.70 leading power factor the losses will be practically the same as in a similar feeder transmitting the same load at 0.70 power factor lagging. If the loads combined at the generator, the power factor of the combination would be about unity. A generator supplying a load having a leading power factor

will require a smaller field current than one supplying a load having a lagging power factor. This is due to a leading current in the armature acting in a way to increase the strength of the field from the main poles, where a lagging current tends to decrease the field strength.

The foregoing is more or less secondary in your problem. Where the load varies over a wide range, such as in your case, the static condenser should be made in two or more sections. This will allow adjusting the condenser capacity to suit the load conditions. If the condenser were divided into two equal parts, during the night load one-half of the condenser could be connected on to the system and the power factor would probably be about unit. In the day time the other section would be added and operation obtainable as at present. It would probably be uneconomical to operate the 120-kva. condenser on your night power load. Before the most economical arrangement could be suggested, one would have to know more about the load conditions than is given in your question. It may be that one-third of the condenser would be proper for the night load.

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RETUBING WHEN TUBE HOLES ARE TOO LARGE—*What is the best method of replacing 4-in. tubes in h.r.t. boilers when the tube openings are much enlarged by rerolling? Can ferrules be used?* P. J. W.

If the holes do not exceed the diameter of the tubes by an amount greater than $\frac{3}{32}$ in., the A.S.M.E. code permits the use of ferrules. This pertains to new boiler construction.

For old boilers, copper ferrules can be used up to about $\frac{3}{32}$ in. For greater clearances a thin soft steel shim, or ferrule, can be used, although the practical limitation is a shim thickness of about $\frac{1}{8}$ inch.

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SINGLE-PHASE WATT-HOUR METERS ON A THREE-PHASE LINE.—*Can a 400-volt, 3-phase, 60-cycle load be accurately metered with two single-phase watt-hour meters? If this can be done, what would be the total power consumption, when, over a given period, one meter recorded 185 kw.-hr. and the other 214?* G. E. H.

Two single-phase meters can be used to record the power consumption on a three-phase circuit. The sum of the meter reading gives the total power used. For example, in the question the total kilowatt-hours is 185 + 214 = 399. Care should be exercised to get the meters connected correctly, otherwise the sum of the reading may not give a correct result for the total power.

There are three reasons for the power recorded by the two meters not being the same. One is wrong connections of the meters, in which case the instruments will not give a correct record of the power delivered by the circuit. A second cause of unequal readings of the two meters is unequal loading of the three phases. Even when the three phases are equally loaded, unless the power factor is unity, the readings of the two meters will not be the same. At power factors less than unity one meter will tend to run faster than the other, but the sum of the two readings will be the total power supplied. As the power factor decreases the slow meter will stop at 50 per cent power factor. Below 50 per cent power factor, this meter will reverse and run in the opposite direction. Normally, this condition need give no concern, since the power factor of most systems is above 50 per cent. If two single-phase meters were used to determine the power taken by a three-phase-induction motor at no load, then it would be necessary to make sure that one of the meters was not giving a negative reading.

PREVIOUS QUESTION

DISCUSSED BY READERS

THE QUESTION

IF WE use a zeolite system on the cooling water of a Diesel engine plant will the concentration of sodium carbonates effect the engine performance.

G. R. M.

A ZEOLITE softener has been in use for some four years in treating the cooling water for the Duncan, Okla., municipal light plant, a plant with an installed capacity of 2,150 hp. in four Diesel units.

The raw water available is very high in calcium salts and quickly gives trouble with excessive scale in the engine jackets if not treated. The zeolite-treated water is used in an open cooling system, the cooling being effected through an open spray pond. Approximately 5,000 gal. per day is treated in the zeolite softener and added to the spray pond to make up the losses by evaporation and windage.

The zeolite-softened water is high in soluble non-scaling sodium salts, and as the spray-pond water evaporates, rapidly becomes more and more concentrated. We have had little trouble from scale in the jackets since using the zeolite-softened water, but find that the soluble sodium salts make the cooling water quite corrosive. During the past four years we have seen little effect of this corrosion on the cast-iron surfaces of the engine jackets or the brass parts of pumps and valves, but corrosion is very much in evidence in the steel water piping. Little piping has failed and been replaced, though the effects of corrosion are quite pronounced. On the last unit installed this year, a 600-hp. Diesel, cast-iron and brass piping was used for practically all the cooling water piping.

At irregular intervals we also let the greater part of the spray pond water run to waste and start over again with fresh zeolite-softened water.

In spite of corrosion of piping, under our conditions, we consider the zeolite-softened water a decided advantage over raw water with its expense of cleaning jackets and possibility of damage to the engines through excessive scaling.

Duncan, Okla. J. H. BENDER
City Manager

—❖—

WE HAVE operated a Diesel-engine plant for three years, using a zeolite softener for supplying the make-up water to the cooling system.

The water jackets of the cylinders and heads show no scale to date.

We find that mud will settle in the water jackets where the circulation of the water is slow. This can be removed easily by washing with a hose after every two or three thousand hours of operation.

When a joint in the piping of the cooling system starts to leak, a yellow deposit will form around the leak, which if left on the pipe will become very hard in a few days.

To keep the concentration of sodium carbonates and other matter down we catch all the rain water from the roof of the plant. We also drain part of the water from the pond every month or six weeks, depending on the amount of make-up we have to supply, due to windage and evaporation.

With a little care an engineer will find no trouble with a zeolite system of softening. W. W. DINGWALL
Central States Electric Co.

Walthill, Neb.

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THERE should be no serious trouble, providing the engineer uses ordinary vigilance.

However, if he permits the water to get too concentrated, it will become saturated with the sodium salts, providing it is cooled in a spray pond or cooling tower. Upon becoming saturated further evaporation will cause some of the salts to go out of solution and settle as a mud. Ordinarily, this will occur in the pond, but it may occur in the cylinder jacket.

A second difficulty is that as the concentration increases the specific heat decreases, so that with the same rate of water flow, the water-outlet temperature will rise. This can be counteracted by increasing the flow.

Tulsa, Okla. JAMES F. HOGAN

Land a Negligible Factor in INDUSTRIAL POWER COSTS

By J. H. Lawrence
President, Thomas E. Murray, Inc.
AND
J. A. Frieday
Mechanical Engineer

MANY excellent power station designs may be seen in recent industrial development, but as a whole power plant design in industrial concerns has lagged behind the example set by the central stations. This is largely due to the attitude of the owner, who pays no attention to this phase of the establishment and leaves the matter entirely to his master mechanic, even though this individual may have his hands full keeping the plant going. The owner generally expects this man to be a designing engineer, as well as operator and mechanic.

There are many master mechanics fully capable of designing their own plants, but generally the duty of keeping a plant in operation is all that should be expected of them. It is absolutely necessary that the manufacturing equipment be kept in good running condition in order to turn out salable products, and a man's attention should not be distracted from that duty by the innumerable details of designing a new or an extended power plant.

Power Plant Design Not Always Simple

The design of a power plant is not a simple matter. There is more to the selection of an engine than just getting a piece of equipment that will turn out power. There is more to a boiler than just a vessel to evaporate water. A thorough study should be made to determine the economical pressure at which the steam should be generated, the rating at which the boiler should be operated, the amount of process or heating steam, and the pressure or pressures required for this service: the cost of available fuels; the cost of equipment, and many other factors that may effect the cost of the electricity or steam generated. Many owners today do not realize the savings possible by the utilization of bleeder turbines, which in some plants deliver power for little more than the fixed charges.

It is our business as engineers to know how to do these things; to know the factors that must be determined before proceeding with the design and to make the proper selection of equipment and arrangement of apparatus to meet these facts. It is our duty as engineers to determine for the builders of industrial plants whether it is more economical to generate or to purchase their power requirements, as the generation of power by an industrial plant cannot always be justified economically.

There seems to be a general misconception even among engineers as to the cost of land for power plants. The tendency seems to be to relegate the power plant to that part of the property which no one else wants. This is a mistake, as the cost of the land for the power house is only an insignificant percentage of the total cost of the plant. A study of the costs of central stations showed that land represented less than 1 per cent of the entire cost of the projects.

In New York City the cost of land for the three plants erected in the last ten years represents an investment of less than one and one half dollars per kilowatt of the ultimate capacity of these stations.

Outside New York, costs are in some cases less than 25c. per kilowatt.

Selection of Power Plant Site

Since the cost of land is a negligible figure, judgment should be used in the location for the power plant. It should not be shoved off into a place that no one else wants, as very often this results in a design of power plant that costs considerably in excess of what it should. The space allotted may be entirely unsuited for the purpose and may result in expensive building construction and high operating costs.

An abstract of a paper given before the Pittsburgh section of the A.S.M.E. It contains comments on plant location and on the effect of building size on initial power plant costs. The original paper gave an economic comparison between plants designed to generate power and supply steam for process steam and plants designed to supply process steam only. This comparison has been developed to show how the various figures were obtained and will be published in a future number

If owners are progressive, they expect their business to grow, and if this does happen, they want to expand their manufacturing facilities in a logical fashion. However, they usually do not take into their calculations the corresponding increase of power requirements, but squeeze the power plant into a cramped space between other buildings. As a result, when more power is required, the old equipment must be replaced with new equipment of larger capacity, or another plant must be built to take the increase.

This condition exists in many plants. Careful planning would have provided for the extension of the power plant, so as to obviate the necessity for an extra operating crew and also increased fixed charges. A dollar saved in power is worth just as much as a dollar saved in manufacturing.

High Cost of Power Plant Structure

The statement is often made that because land is cheap, the designer has been liberal with space around equipment. As stated above, land is relatively cheap, even in the larger cities. But are buildings cheap? Costs of stations show that structural costs are a large item, in comparison with which land is a mere drop in the bucket. A study of central station practice made three years ago, and the figures are fairly representative today, showed that the buildings cost from $25 to $55 per kilowatt installed capacity. This cost is from 25 to 35 per cent of the total cost of the stations.

The results of the survey are shown in Fig. 1, and are divided into two groups. Curve *A* is for stations in the larger cities, where architectural treatment is generally given more attention than in the other group. Also these stations are distributing as well as generating stations. The curve *B* is for stations in smaller communities, where the bulk of the output goes out over high-tension lines to be redistributed at substations.

It is plainly evident from these curves that excessive liberality in space is expensive. The operating man wants plenty of elbow room, but the cost is sometimes alarming. Let us study curve *B*. It will be noted that a station having a volume of 45 cu.ft. per kilowatt should cost approximately $91 per kilowatt. A station having 75 cu.ft. per

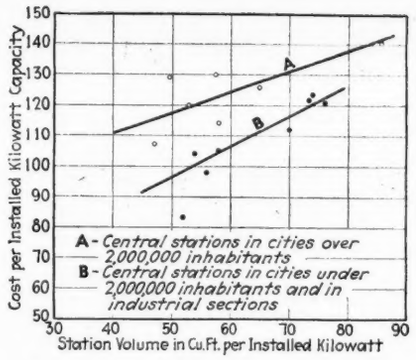


Fig. 1—Effect of station volume on initial cost of power plant

kilowatt should cost approximately $121 per kilowatt, showing a difference of $30 per kilowatt. At 12½ per cent fixed charges and 45 per cent load factor this difference represents a cost of one mill per kilowatt-hour, or as much as the cost of labor and maintenance in the average plant studied. Liberality in space cannot, therefore, be justified on the ground of labor savings.

The results shown above, while for larger power stations than found in industrial establishments, are indicative of general practice in power plant design. It is not recommended to use shoe-horn methods for squeezing apparatus into cramped quarters, but the value of liberality of space should be considered. We should appreciate the fact that progress is being made in power plant design and that we can now get considerably more capacity per square foot than we could ten years ago; and that ten years from now we shall wonder why we wasted so much space in this year of 1929. Boiler capacity has quadrupled per square foot of ground area in the last five years due to the development of the water-cooled furnace, and the same ratio holds true for the turbine rooms.

There are two opinions prevalent among industrialists that we believe are erroneous.

High Ratings Profitable

The first is that it does not pay to force boilers to high ratings in industrial plants, say over 250 per cent. This probably is due to past experience, when considerable trouble was experienced with furnace maintenance. Today we are more familiar with this problem and it is no longer a hindrance. It is safe to say that the limit now is the economic balance between efficiency of combustion and power for fans, on one side; and fixed charges, on the other.

The other opinion is that high ratings mean punishment of the boiler. This latter, however, is gradually being discarded, as experience has shown that boilers are capable of producing much more steam than it was thought possible even ten years ago. If proper treatment is given to the feed water and the furnace is properly designed, there is no reason why boilers cannot operate for months at high ratings without shutdown for repairs to pressure parts.

License Regulations for Engineers in Quebec

By Philip C. Bradshaw
Montreal, Que.

With Quebec at last a signatory of the Interprovincial Boiler Code, N. S. Walsh, chief examiner of the province, informs *Power* that drastic changes will be made early in the coming year to co-ordinate within his department not only the examination of operating engineers, but the approval of new boiler installations and the inspection of all boilers in operation. This makes it certain that the strenuous efforts Mr. Walsh has made for the past three or four years have at last borne fruit, and that as a result the province is certain now to amalgamate the three departments, which, operated as individual units, react to the detriment of equipment maker, owner, and operator, in other provinces.

Classifications Based on Engine Horsepower

In 1929 there were 4,662 renewals of certificates of all grades granted in Quebec, the regulations aptly enough being based on engine horse power not boiler horse power as in most of the other provinces.

The fee for the examination of a first class engineer, qualifying for boiler inspection work, either for the government or for a private company is $25.00. For all other first class engineers the examination fee is $15.00. For a second class engineer the fee is $10.00; for a third class man $5.00; and for men seeking fourth class tickets, $2.00. Holders of first class certificates are entitled to take charge of plants of 400 hp. or more; second class certificated men of 180 to 400 hp.; third class men from 50 to 180 hp., and fourth class men of less than 50 horsepower.

General Regulations

As a basis for the preparation of all examination papers the act at present applying to stationary engineers stipulates that firemen and engineers of the fourth class must understand how to fire as economically and as intelligently as possible. Such men must be familiar with the feed appliances, valves, injectors, and other equipment necessary to maintain the proper water level required to insure the satisfactory working of boilers. They must also know the use of the steam gage, glass gage, safety valve and be familiar with the running, care, starting and stopping of a steam engine; the handling and repair of belts and their shifters; the oiling and lubricating of steam engines, shafts and other equipment. To act in a fourth class capacity a fireman must have had at least one full year under the control of a qualified engineer.

Applicants for third class certificates must be 21 years of age and have served at least one full year as fireman, or a three years' apprenticeship at the construction of engines and boilers, or have been employed as a journeyman at the construction and repair of engines and boilers. He must be able to describe boilers, the manner in which they must be stayed and repaired and the accessory fittings they should have. He shall be able to line up an engine, adjust the eccentric, set the valves of engines and pumps, understand the steam gage, injector, safety valve and have sufficient experience to detect deficiencies in these appliances and know the best means of repairing them.

Second class engineers must have given the same time of service and possess the same degree of education that is required of an engineer of the third class. He must, however, be able to make drawings of a steam boiler and engine and be able to explain the principles upon which such apparatus work. He must be able to adjust valves and pumps and at the same time describe the different types of boilers, their practical installation, the laws that govern the strength of plates and joints and the proper distribution of the motive power in an establishment. Second class men must also be familiar with the best practical methods for overcoming dirt deposits and scale incrustations in boilers.

Requirements for First-Class Certificate

An applicant for a first class certificate must be able to calculate the direct tension, the twisting and bending strains on rectangular or round bars of iron or steel when submitted to certain loads. He shall be able to calculate the area of safety valves required on boilers of certain dimensions, the required capacity of feed pumps and the power of a machine from its given working indicated diagram. He shall be able to calculate the diagram furnished by the indicator and be familiar with the problem relating to the condensation of steam, the over-heating and expansion of metals, He must be familiar with air compressors or freezing plants, as well as the dynamos and motors of ordinary type. He must know the relative expansion of steam at different temperatures, the constituent chemical composition of coal and the required quantity of air for combustion. He may be required to make a working drawing of any of the parts of an engine and boiler and his knowledge of figures should extend to the extraction of the square and cubic roots and the measurement of areas and solids. A candidate for a first class certificate must be able to prove that he has had at least three years' experience at the construction of boilers or engines, as a mechanic.

NEW BOOKS

FORMULAS AND TABLES FOR ENGINEERS. Third Edition. By Pierce, Carver and O'Rourke. Published by McGraw-Hill Book Company, New York, 1929. Imitation leather; 4½ x 7 in.; 228 pages; illustrated. Price, $2.50.

THIS third edition of a well-known handbook of formulas and tables has been revised, brought up to date, and additional material has been included. In its present form it covers mathematics, measurement, physical and chemical properties of substances, mechanics, columns, beams, jointed frames, structural data, reinforced concrete, strength of materials, standard gages, fastenings, flanges, steam tables and charts.

Some of this material is presented in a somewhat more extended form than is usual in handbooks. However, since the scope of the work is confined to the subjects mentioned above, the volume remains small enough for convenient handling.

THE ST. LAWRENCE NAVIGATION AND POWER PROJECT. By Harold G. Moulton, Charles S. Morgan and Adah L. Lee. Published by the Institute of Economics of the Brookings Institution, 1929. Cloth; size 5½x7½ in.; illustrated; 675 pages. Price, $4.

ALTHOUGH the St. Lawrence River, from Lake Ontario to Montreal, is only 183 miles long, and falls 226 ft., it is one of the greatest sources of water power in the world. This stretch of the river is also the greatest barrier to oceangoing boats entering the Great Lakes. For these two reasons the St. Lawrence River has attracted a great deal of attention for many years. Numerous reports have been made by national and international commissions, engineering boards, and others on the possibilities of developing the St. Lawrence River as a deep waterway in conjunction with its power projects.

In this book the authors have taken the vast printed material available on the St. Lawrence River and presented a consistent story on both the power and transportation aspects of the project. Not only is the St. Lawrence considered, but other projects that have a bearing on this development have been brought into the picture. The work is the result of the co-operation of a number of economists, traffic experts, and engineers working over a period of several years.

The conclusions drawn from the analysis are not favorable toward developing the St. Lawrence as a deep waterway. If it is to be developed, a depth of 33 ft. would be required instead of the proposed 27 ft. It is also claimed that the route would be of negligible value in affording relief to the American farmer.

In regard to the power developments, it is pointed out that these projects should not be expected to subsidize navigation. Even were there an excess revenue from the sale of water power, it by no means follows that such funds should be used to support navigation. These conclusions many of the friends of water power development will heartily agree with. However, the statement "Our analysis indicates that, although the development of the St. Lawrence hydro-electric energy will, in the course of time, doubtless be economically profitable, its exploitation at present would be premature," can hardly be justified, even at this time. The Beauharnois development now under construction is a very substantial beginning toward developing the St. Lawrence power and navigation facilities, and is being done by private capital. With the rate that power consumption is increasing in Quebec and Ontario, it is likely that even more St. Lawrence power will be required in the near future.

Whether one agrees with the authors or not, it must be conceded that they have presented a comprehensive story of this great power and navigation project. Those interested in this development will find this book worthy of their careful consideration.

DIRECT CURRENTS. By Carl E. Magnusson, Professor of Electric Engineering, University of Washington. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York City. Cloth; 6 x 9 in.; illustrated; 495 pages. Price $4.50.

WRITTEN for specific use as a textbook, the author has presented in logical order the basic principles of the electric circuit and the characteristics of direct-current machines. This book is intended, when combined with the author's works on "Alternating Current" and "Electric Transients," to form a set of electrical engineering texts covering the fundamental laws of electrical phenomena as applied to practical electrical engineering problems.

In treating the electric circuit, the magnetic and dielectric circuits and fields, which are co-existent with the currents flowing in the circuit, are considered. A chapter has been devoted to each of the subjects: The electric circuit; the magnetic circuit; the dielectric circuit; the dielectric field; and the magnetic field. In these and other chapters in the first part of the book fundamental principles are set forth, and are then applied to a study of direct-current machinery and circuits, as indicated by the chapters on the dynamo, armature winding, generator and motor characteristics, storage batteries, thermonic, gaseous conduction and other subjects.

Since the book has been written for a college text, the subject matter has been presented with a free use of mathematics, which is a characteristic of such courses. However, the mathematical formulas have been applied in conjunction with a liberal use of practical illustrations in a way that combines a picture of the object discussed with academic theory.

FORTY YEARS WITH GENERAL ELECTRIC. By John T. Broderick. Published by Fort Orange Press, Albany, N. Y., 1929. Cloth, 5 x 7½ in.; 220 pages; illustrated. Price, $2.50.

IT HAS been said that a corporation is without a soul—impersonal. But John T. Broderick, in his book about the General Electric Company, successfully personalizes that great institution to the reader who is not familiar with it. No one can come away from a perusal of his pages without a heightened comprehension of the intensely interesting human element that underlies all modern business.

Basing his writing on a long and active connection with the company, Mr. Broderick has distilled the essence of his many contacts with its leaders to show the spirit and the ideals that have made possible the huge, successful concern that we know today. Starting with the men he chooses to call the founders—Coffin, Thomson and Rice—and leading on through Griffin, Lovejoy, Steinmetz, Whitney, Langmuir and others, the development of policies and methods is brought out.

Perhaps most interesting to those who would use this work as a textbook for success, are the chapters dealing with research. The General Electric Company is known the world over as a leader in both pure and industrial research. How this has come about and why such leadership is maintained are valuable facts for anyone, in any business, anywhere.

AN INVESTIGATION OF THE FRIABILITY OF DIFFERENT COALS. By Cloyde M. Smith. Published as Bulletin No. 196 of the Engineering Experiment Station at the University of Illinois, Urbana. Price 30 cents.

THE investigation reported in this bulletin was undertaken for the purpose of developing a means of gaging the comparative friability of different coals. The inherent friability of a coal, or the susceptibility of a boal to break in handling, has a marked influence on the extent to which it is broken down, or degraded, in the numerous processes involved in mining, preparation, and marketing.

This report covers the results of several hundred individual tests on the breakage of coal, the principal form of test being to drop a weighed amount of sized coal through a measured height onto a platform of wood, steel, or concrete. Several coals from different parts of Illinois were tested, and in addition a number from without the state, in-

REVIEWED

cluding anthracite and Pocahontas coals, thought to represent about the two extremes of friability.

GAS WELDING AND CUTTING: Instructions for Beginners in Gas Welding and Cutting. Compiled and published by the American Welding Society, 33 West 39th St., New York. Revised, 1929. Paper; 9 x 9 in.; 78 pages; illustrated.

THE American Welding Society, and its educational committee are to be congratulated on the thoroughly practical nature of this book and upon the skill with which the material has been presented. This revised edition contains ten chapters, covering the following subjects: fundamentals of gas welding; character of gases and their uses; materials and apparatus; making and testing the weld; preliminary and practice work; welding cast iron; gas cutting; welding steel and wrought iron; welding non-ferrous metals; qualifications for gas welders. The book is of definite practical value to any beginner in the art of gas welding and cutting.

POWER PLANT COSTS. By N. K. Chamberlin. Published by the National Educational Committee of the National Association of Power Engineers, 1929. Paper; 6 x 9 in.; 95 pages. Price, $1.

ONE great difficulty of obtaining cost data and keeping cost records is the large amount of detail involved. In a power plant of any considerable size the relation of the individual item recorded to the co-ordinated cost account required for an accurate picture of the plant's economic functioning is often lost sight of in a maze of irrelevant factors. Many plants are overburdened with forms to be filled out and records to be kept, while others lack even the barest semblance of a system. Obviously, the chance of securing a correct and adequate cost analysis in either case is slight.

While no standard method of costing has been devised that will fit the varying requirements of each power plant, certain broad principles form the foundations of every system of accounting. These are ably presented with their applications in this new N.A.P.E. manual on power plant costs. Here one learns what information must be acquired for an accurate cost analysis, how to obtain it in the plant, and how to interpret and make use of it.

Starting with the main reasons for determining costs, the first part of the book is devoted to the theory of cost segregation. A lucid explanation of the distinction between fixed and operating charges is presented, followed by an application of the principle to a simple theoretical plant, which serves to emphasize the relation of the various factors to each other.

The next section of the manual contains a detailed analysis of the isolation and determination of the elements in a cost analysis. The use of permanent statistics, operating cost records and forms is considered. Methods of determining interest and depreciation, including rate tables, are given. Ways of securing accurate data on operating charges are outlined in detail. Finally, the co-ordination of data to form completed cost analysis is treated, with suggestions as to the use of charts and the forecasting of results.

The last part of the book is given over to the presentation of the complete record system of an actual power plant. All of the forms, records and charts are reproduced, with explanations of their use. While these serve as elaborate illustrations of the application of cost accounting to one specific plant, they cannot, as the author emphatically points out, be adopted for use in any other plant without being changed to meet requirements. An understanding of the principles of costing as outlined in the first part of the book is essential to make this adaptation.

INDUSTRIAL DEVELOPMENT IN THE UNITED STATES AND CANADA. A co-operative survey by the Civic Development Committee of the National Electric Light Association and the Policyholders Bureau of the Metropolitan Life Insurance Company.

WITH the ever-increasing expansion of public utility power and light companies there came an urgent need for information regarding the trend and geographical distribution of industrial development in the United States and Canada. On investigation, the National Electric Light Association found that no data isolating the migration of industry and giving the expansion of industry within the individual community were readily available.

Almost immediately it was found that very little if any statistics on the expansion of industry within the community was obtainable, because records of this had not been kept by the individual communities, so that part of the survey had to be abandoned. Information on the migration of industry for the years 1926 and 1927, however, was secured from the chambers of commerce of towns and cities throughout this country and Canada, state and provincial labor departments, the United States Chamber of Commerce and the Department of Commerce, and has been incorporated in this report.

In tabulating the results of the survey the gains were split up under three headings—relocations to, new branches and new industries; and the losses, under two—relocations from and discontinuance of business. The two countries were divided geographically, and each area intensively canvassed. Statistics were obtained from 1,934 cities representing 75 per cent of the urban population in the United States and 150 cities representing 66 per cent of the urban population of Canada.

Among the many interesting facts brought out in the report is that for this country as a whole, relocations constituted only 9.4 per cent of the development and new branches 8.8 per cent. A similar condition existed in Canada, emphasizing the relative unimportance of these factors in the growth of industry. New industries, however, accounted for the remainder or bulk of the development. The majority of the losses were due to industries that went out of business. A net gain of 50 per cent was shown for all cities of this country, and the greatest gains of any geographical division were made by the Middle Atlantic states—New York, New Jersey and Pennsylvania. Factors influencing the choice of new sites were not the same for all industries, but markets, labor, transportation and materials were listed among the first four in nearly every case.

More than anything else the report emphasizes the importance of keeping records on these various factors in the industrial development of the country. Each community is urged to collect and keep up-to-date statistics of this nature, so that it may have an accurate picture of its industrial growth.

PROTECTION OF ELECTRICAL CIRCUITS AND EQUIPMENT AGAINST LIGHTNING—For some years a project has been under way, under the auspices of the American Standards Association, to formulate standards for the protection of electrical circuits and equipment against lightning. Present practice in this field has not crystallized to the point where it was felt that definite standards could be established. Information, however, has been collected as to methods of protection now in practice that have been found satisfactory in dealing with lightning disturbances. This book, which contains 107 pages, is a preliminary report of the sectional committee on protection agains lightning and has been published as "Miscellaneous Publication of the Bureau of Standards, No. 95." Copies may be obtained from the U. S. Superintendent of Documents, Government Printing Office, Washington, D. C., price 25 cents.

"NOTE SUR LES CONNAISSANCES ACTUALLES DES PROPRIETES DE LA VAPEUR D'EAU," by M. D. Sochagzewer, discusses, in 103 pages, the experimental background of the various steam tables and diagrams in common use in the United States and Europe and compares them critically. The booklet is published by Dunod, 92 Rue Bonaparte (VI), but the price is not noted.

Events and Men in Power's Field

THE EDITORS WILL WELCOME THE CO-OPERATION OF READERS IN REPORTING INTERESTING HAPPENINGS, PERSONAL OR OTHERWISE

Spot * News

INSTALATION *of a new 110,000-kw. turbine-generator in the Hudson Avenue station of the Brooklyn Edison Company is the only important addition to generating facilities included in the recently announced $80,000,000 construction program for 1930, of the New York Edison and associated companies.*

* * *

NEW ORDERS *for 1,239 steel boilers were placed in November, as reported to the Department of Commerce by 80 manufacturers comprising most of the leading firms in the industry, as compared with 1,712 boilers in October and 1,660 in November, 1928.*

* * *

AS A PROTEST *against a recent increase that made electric light rates exhorbitant, the business community and householders of Lisbon, Portugal, have returned to the use of candles and oil lamps for illumination. Even theaters are shorn of most of their display lighting.*

* * *

PURCHASE *of a 25,000-kva. vertical water-wheel generator of the new umbrella design has just been made by the Tennessee Electric Power Company for its Blue Ridge hydro station from the Westinghouse Electric & Manufacturing Company.*

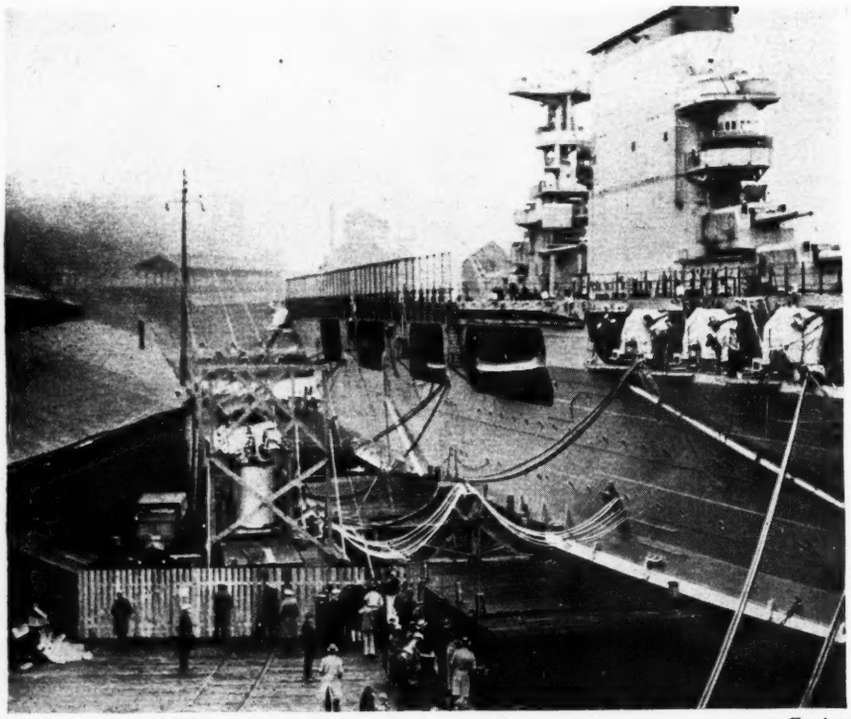
* * *

TRANSMISSION LINES *were damaged and many towns were without light and power in northern and eastern New York as a result of severe storms recently. The majority of the lines gave way under the weight of tons of ice formed by freezing rain.*

* * *

POWER *developed at Boulder Dam should be sold at as high a price as the purchaser can afford to pay under competitive conditions, and not merely at as low a price as will safely insure the repayment of money spent by the federal government, according to a letter received by Secretary Wilbur from representatives of the four states in the upper Colorado River basin, who met recently in Denver. Otherwise, the industries of southern California will be favored over those of Utah, Nevada and Arizona, the letter states.*

Novel Engineering Features in Lexington's Connection with Tacoma



Keystone

SOME interesting problems in equipment protection, transmission and transformation were handled in the general problem of tying in the United States Navy airplane carrier Lexington's generating plant with the power supply of the Tacoma, Wash. As reported last week on page 1025 of *Power*, the ship will furnish 20,000 kw. to the city for a period of 30 days while water is stored at the municipal hydro plant on Lake Cushman.

The Lexington, one of the two largest ships afloat, is 900 ft. long, with its airplane deck about 50 ft. above the water line. It has a draft of 35 ft., and, taking its condensing water out through the bottom skin, requires a considerable depth below this draft to avoid sucking up sand and silt from the ocean bottom. These considerations made necessary the choice of the Baker dock at Tacoma as a berth for the ship, since this was the only dock where such depth could be obtained. By breasting the ship out from the dock 30 ft. by barges, a depth of 80 ft. was obtained, which is deemed by navy officials to be sufficient.

In brief, the ship's driving equipment consists of four 42,500-kva., or 35,200-kw., three-phase, alternating-current generators, developing 180,000 shaft horsepower. Power from these generators is supplied through suitable controls to eight 22,500 to 5,500-hp. propulsion motors direct connected in pairs to four propeller shafts. The generators have varying voltages up to 5,000 and varying speeds and cycles up to 1,800 r.p.m., giving 60 cycles at normal load. Seventeen different combinations of operating the generators and motors are possible through pneumatically operated contactors, manually controlled from the control room, situated between the generators and the motors. There are no oil switches on board, and it is necessary to kill the generator field before switching.

It was planned to disconnect the leads of one generator at one motor, tie these direct to a temporary bus structure in the motor room, at the other end of which would be tied the cables leading to oil circuit breakers and transformer banks on shore. Generator voltage for the tie-in with the city was approximately 4,600. The temporary bus forming the physical connection between the ship and shore cables necessarily had to be located at the point where the motor leads are disconnected, or within about five feet of the bottom of the ship. From the point where the shore cables were tied to this bus, up companionways and along passageways, to a door in the skin

of the ship some 20 ft. above water line it is about 110 ft. From this point across the intervening space between the ship and the dock, with sufficient slack to provide for a 17-ft. tide, there is about 160 or 170 ft. of cable transmission to the oil circuit breakers. For this purpose there was available a quantity of 750,000 circ.mil, single-conductor, paper-insulated cable. Power was taken into the city's system through two 10,000-kva. transformer banks in parallel, so that two lengths of cable per phase were necessary, requiring a total of twelve lengths in the two circuits from the ship's hold to shore. Some form of protection from the weather, probably by wood stave pipe mounted on supporting structures on the barges between the ship and the dock, will be provided for the cables.

Two Transformer Banks

Two identical transformer banks, each with its oil circuit breaker, were mounted on two flat cars and run in on the dock track opposite the position of the point of exit of the cables from the ship, as shown in the illustration. Each bank consists of three 52,500 to 4,620-volt delta-star, 3,333-kva. outdoor-type transformers, one bank being of air-cooled Westinghouse, and the other of water-cooled Allis-Chalmers. The oil circuit breakers are each 15,000-volt 1,200-amp. General Electric FH 203, truck-type, with a rupturing capacity of 350,000 kva. A housing will be built over these, since they are of the indoor-type. The transformer banks had recently been replaced with a single 20,000-kva. bank at the Cushman substation, and one bank was lying idle, while the other, though in service at another station, could be removed.

The primary sides of the banks were connected in parallel to a common bus leading directly to a temporary 50,000-volt transmission line ending at a point on the dock near the transformers. This line, extending principally along Tacoma Ave. was tied in with a 50-kv. tie line between Cushman and Nisqually substations. No details were available as to how the ship's power would be operated and its load dispatched, but arrangements included a private telephone line from the ship's control room to the city load dispatcher's station.

Beerbower Station Ready for Operation

Virtual completion of the Oklahoma Gas & Electric Company's 15,000-kw. Lincoln Beerbower station near White Eagle, Okla., is announced by H. W. Fuller, vice-president in charge of engineering, the two initial units having gone into service many days ahead of scheduled time. Completion of this station brings the total capacity of the Oklahoma Gas & Electric Company's system up to 160,706 kw. This will be further augmented next year by a 30,000-kw. steam-electric station, construction of which has recently been started near Belle Isle Lake in Oklahoma City.

Many Bills Affecting Utilities Expected at 1930 Session of N.Y. Legislature

AN unusually large number of bills relating to public utility interests is expected to be introduced in the New York State Legislature during 1930.

Development of water power by the state or by a state agency is said to have gained the support of a number of up-state members of the legislature. Water-power development is one of the pet hobbies of Governor Roosevelt; it has been a part of the Democratic program for many years but a Republican legislature has prevented the passage of the necessary laws to put it into effect. Whether a sufficient number of up-state legislators will support measures to bring about such development at the coming session of the legislature remains of course to be seen. Certain it is through chambers of commerce, manufacturing interests, and the like, there is a growing clamor for some sort of legislative action. This year both the New York State Federation of Labor and the Mayor's Conference have announced their support of this principle.

A special legislative commission has been at work many months endeavoring to find out what is the matter with the present public service commission law. Exhaustive hearings have been held. It is expected much legislation will be introduced as the result of this investigation.

Conferences have been held by Governor Roosevelt with utility representatives with the idea of devising a uniform system for determining rural rates and charges for electric service. Whether or not an agreement is reached and a plan evolved by the utility corporations, legislation on this subject, both friendly and hostile is to be expected when the legislature convenes.

The recent combination of up-state utility corporations into one system under the holding company plan, which brought forth an opinion from the New York State Attorney General that such a combine in such a way is entirely legal, is bound to result in proposed legislation to give the public service commission jurisdiction over holding companies and investment trusts acquiring and holding public utility stocks, bonds and securities. While this matter has been touched upon by the special commission investigating the public service commission law, much independent legislation along this line is anticipated.

The general relationship of other holdings of investment trusts and holding companies which own the controlling interest in public utility corporations, in respect to the possible effect of such other holdings upon rates fares and charges of utility corporations whose interests are controlled by the same holding company, will also receive legislative attention.

There will probably be many tax measures introduced that will be of vital interest to utility corporations.

Business Forecast

IN ITS issue of Jan. 1, 1930, the *Business Week* will print the following outlook for business:

"At the turn of a year like this slight signs of the direction of the business movement from week to week become significant. If they show the patient is not getting worse, they give some ground for believing he is getting better.

"There are several such in the latest indicators covering the second and third weeks of December. Steel production is holding a fairly constant level at a time when sharp curtailment is usual. Carloadings of non-bulk goods are not dropping further below last year's figures than they did during the latter part of November. General trade, as measured by check payments in cities where the slackness of stock trading at this time would not affect the figures, made a good comeback in the pre-holiday week and was practically at last year's level.

"All these things suggest that the holiday stimulus to trade was fairly normal and that the general expectation of returning business confidence and of impending revival of industrial activity early in the year is being justified."

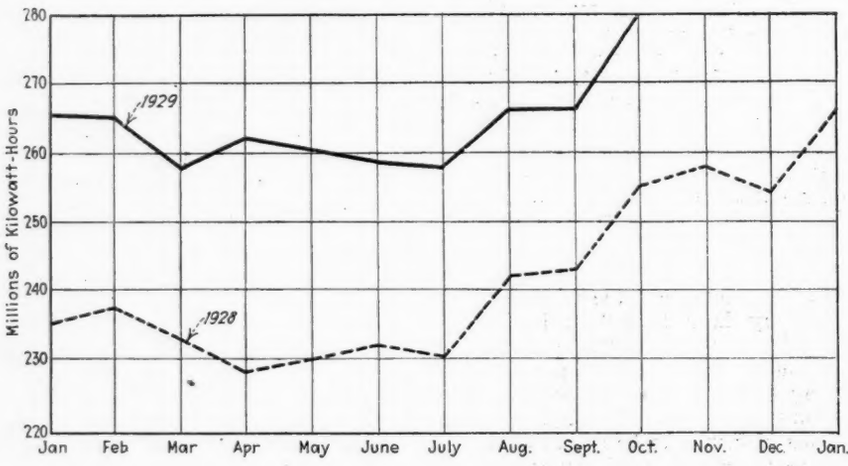
Large Hydro Plant Opened in New Zealand

One of the largest gatherings of Maoris during recent years unexpectedly greeted Sir Charles Fergusson, Governor-General of New Zealand, at the official opening of the Waikaremoana hydro-electric power plant, the last of the three major power schemes of the North Island.

Thousands of years ago a vast mountain split in two and blocked a valley, forming the Waikaremoana Lake, 1,000 ft. above the sea, 800 ft. deep, and with an area of 20 square miles. Government engineers have tapped one of the numerous leaks in the mountain side and harnessed the water of the lake, so as eventually to drive in succession turbines in three power houses at different levels.

The new installation provides 40,000 hp., but the potential capacity is 190,000 hp. It will be tied in with the Arapuni plant, of 96,000 hp. capacity, and the Mangahao plant, of 24,000 hp. capacity.

Utility Power Production Reaches New Peak as Year Ends



A NEW peak in the production of electric power by public utilities will be reached at the close of the year, according to present reliable indications. As shown by the above curve, compiled from the latest figures available from the Department of the Interior, the average daily output on Nov. 1 was 24,000,000 kw.-hr. ahead of last year. There is every evidence that the 1929 curve will continue to parallel that for 1928 and reach a high mark for daily production of 286,000,000 kw.-hr. by Jan. 1.

The production of electricity by public utility power plants during 1929 is now estimated by the National Electric Light Association at 97,000,000,000 kw.-hr., as compared with 87,850,000,000 kw.-hr. for 1928. An interesting comparison on the growth of output during the last 30 years is made by the Department of the Interior, in pointing out that production for eighteen days during October was equal to the total annual production in 1902; in other words, the output for 5 per cent of the year 1929 was greater than for the entire year in 1902.

Hughes Proposes Cut in Chicago Diversion

The long dispute over the diversion of water from Lake Michigan by the Chicago Sanitary District, with its effect on Great Lake levels and incidentally on proposed and possible development of power on rivers fed by the lakes, reached a new stage on Dec. 17, when Charles E. Hughes, acting as special master at the behest of the United States Supreme Court, rendered his report to that tribunal.

In his report Mr. Hughes recommends that the diversion be reduced from the present 8,500 sec-ft. to 6,500 sec.-ft. on July 1, 1930, with the completion of the Sanitary District's North Side disposal plant. He proposes the construction of controlling works to prevent reversal of the current of the Chicago River and canal, by means of which the diversion would be reduced to 5,000 sec.-ft. in two more years. Mr. Hughes' schedule calls for the Calumet plant of the Sanitary District to be completed by Dec. 31, 1933, a West Side plant by Dec. 31, 1935, and another plant by Dec. 31, 1938.

After the last-mentioned date the Sanitary District should not, Mr. Hughes says, unless Congress imposes a different requirement, divert more than an annual average of 1,500 sec.-ft. a second in the interests of navigation in the Chicago River. This would be in addition to water taken by Chicago for municipal purposes. Such an ultimate maximum diversion would have the effect of lowering the level of Lakes Michigan and Huron one inch, the special master asserts.

Chicago will file exceptions to Mr. Hughes' report.

Allocations Recommended for Colorado River

Although no official recommendations were made at the recent conference of Utah, Wyoming, New Mexico and Utah delegates in Denver, tentative figures revealed at that time suggest that a government referee, to be appointed chairman for a January meeting in Denver, will be asked to allocate Colorado River waters, under the Boulder Dam agreement, to upper basin states about as follows:

Colorado, 4,500,000 acre-ft.; Wyoming, 1,500,000 acre-ft.; Utah, 1,000,000 and New Mexico, 500,000. This will dispose of the 7,500,000 acre-ft. designated to the four states' use.

It is forecast that the states will have no great difficulty agreeing on water division, since Colorado, which furnishes approximately 12,000,000 acre-ft., demonstrates a willingness to accept a much smaller amount of Colorado River waters than it might reasonably claim; but a battle is said to be in prospect over utilization of power to be derived from hydro equities.

A formal compact has been prepared governing the future administration of any power project connected with upper basin water rights.

Another 35,000-kw. Unit for Kansas City

The Kansas City Power & Light Company, which has just placed in service a new 35,000-kw. turbine-generator at its Grand Avenue steam plant, announces that it will add another unit of the same rating to that station during 1930. As reported in the Oct. 8 issue of *Power*, the steam pressure in this plant was raised from 185 lb. to 650 lb. to take care of the new installation, which brought the capacity of the station up to 85,000 kw. With the addition of another 35,000-kw. unit, which is to be completed next fall, the capacity of Grand Avenue will be near that of the company's Northeast station, giving a combined capacity of 260,000 kw. for the system.

New Dam Regulation in California

The California Railroad Commission has revoked its previous general order requiring public utilities to file, subject to the approval of the commission, plans and specifications for the construction, reconstruction, alteration or repair of all public utility dams before beginning such work, and has issued a new order, effective Jan. 7, 1930, requiring such plans and specifications to be filed with the commission within 30 days after their approval by the state engineer, California Department of Public Works. This action was taken after public hearing as the result of the enactment by the last state legislature of the Dam Control act, giving to the state engineer jurisdiction over all dams within the state.

A.A.A.S. Holds Meeting in Des Moines

Scientists from all over the United States and guests from foreign countries are assembled in Des Moines, Iowa, this week for the eighty-sixth annual meeting of the American Association for the Advancement of Science, the opening session of which was held last Friday, says the New York *Times*. The meeting will continue until Jan. 3. Men prominent in nearly all sciences will read papers and lectures, presenting data on new developments in their fields.

The Des Moines meeting is being held under the presidency of Dr. Robert A. Millikan, one of the world's foremost physicists and director of the Norman Bridge Physical Laboratory of the

California Institute of Technology at Pasadena.

The retiring president for the meeting is Prof. Henry Fairfield Osborn, president of the American Museum of Natural History. Both Dr. Millikan and Professor Osborn delivered important addresses. Dr. Millikan spoke on "The Alleged Sins of Science," while Professor Osborn's subject at the opening session was "The Discovery of Tertiary Man."

Nearly all domains of science are represented in the sessions of the respective sections and their related societies. The sections embrace mathematics, physics, chemistry, astronomy, geology and geography, the zoological and botanical sciences, anthropology, psychology, social and economic sciences, historical and philological sciences, engineering, medical science, agriculture and education.

Schoellkopfs to Merge Utility Holdings

The Schoellkopfs of Buffalo will consolidate their varied electric utility interests through a merger of the Niagara Share Corporation of Delaware with the Niagara Share Corporation of Maryland, it was announced Dec. 22, according to the New York *Times*. The later company was formed last June and its holdings are largely those of the Schoellkopf intrests in Niagara Hudson Power and other allied electric utility securities.

Niagara Share of Maryland has an authorized capital of 4,000,000 shares of $10 par common stock, of which 3,327,861 are outstanding. Its net assets as of Dec. 2, 1929, were in excess of $45,000,000 at existing market prices.

The Schoellkopf interests are also large owners of Niagara Share Corporation of Delaware, and this company in turn holds a large amount of Niagara Hudson Power stock, with other associated electric utility securities.

A.S.A. Joins International Association

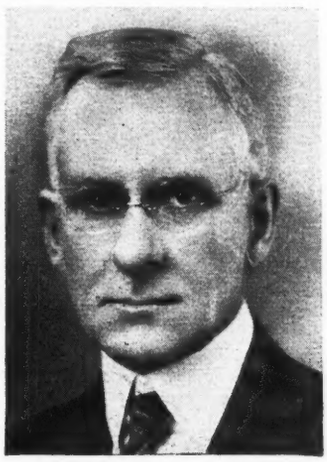
Announcement that the American Standards Association has become a member body of the International Standards Association was made at the annual meeting of the A.S.A. at the Hotel Astor, New York on Dec. 18 by William J. Serrill, president. As the result of this action all of the national standardizing bodies except those of Great Britain, Canada and Australia are members of the International Association. The countries now represented, in addition to the United States, are: Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Holland, Hungary, Italy, Japan, Norway, Poland, Roumania, Russia, Sweden, Switzerland.

Announcement was also made at the meeting of the re-election of Mr. Serrill as president and Cloyd M. Chapman as vice-president for the year 1930.

Edison Medal Awarded to Charles F. Scott

The Edison Medal of the American Institute of Electrical Engineers has been awarded to Prof. Charles F. Scott, New Haven, Conn., "for his contributions to the science and art of polyphase transmission of electrical energy." The Edison Medal was founded by associates and friends of Mr. Edison, and is awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts."

Charles F. Scott, professor of electrical engineering at Yale University, was born at Athens, Ohio, Sept. 19, 1864. His collegiate education was received at Ohio University in Athens, and the Ohio State University, Columbus, from which he was graduated in 1885, and Johns Hopkins University, where he engaged in graduate study.



Charles F. Scott

In 1888, he entered the testing department of the Westinghouse Electric & Manufacturing Company. After receiving experience in the dynamo room, the laboratory, and the development of alternating-current motors, he became assistant electrician, and in 1897 was appointed chief electrician. In 1904 he was made consulting engineer of the company, and in 1911 was appointed to his present position at Yale University.

During his connection with the Westinghouse company, he was a pioneer in high-voltage transmission of power and in the development of several types of equipment, including induction motors and transformers.

Professor Scott, now an honorary member of the A.I.E.E., has been a member since 1892, and was president during the year 1902-1903.

As president of the Society for the Promotion of Engineering Education (1921-23), Professor Scott proposed a serious consideration of methods of improving the teaching of engineering.

In addition, Professor Scott is a member of the American Society of Mechanical Engineers, National Electric Light Association, Illuminating Engineering Society, American Philosophical Society, and Engineers' Society of Western Pennsylvania (past-president).

News of Canada

Manitoba and Alberta Gain Valuable Power Sites— Rain Brings Relief to British Columbia

THROUGH an agreement just entered into between the Dominion Government and the Prairie Provinces, the provinces of Manitoba and Alberta get control of valuable water power sites which for many years have been administered by the federal authorities. In Manitoba the total available water power resources are estimated to be 3,309,000 hp. under conditions of ordinary minimum flow, or 5,344,500 hp. ordinarily available for six months of the year. The total developed water power in this province is 311,925 horsepower.

In Alberta the total available water power resources are estimated to be 1,049,500 hp. under conditions of ordinary minimum flow, or 390,000 hp. ordinarily available for six months of the year. The total developed water power amounts to 34,532 horsepower.

The famous Spray Lakes site, in the Banff National Park area, over which there has been much controversy for years, is located in Alberta. Three years ago, the Calgary Power Company had ambitious plans for the development of power at this site, but the scheme was suddenly halted through the action of the Alberta Legislature in urging the federal government to issue the license for the development of this power to the provincial government. At that time the Prairie Provinces had commenced their fight for the return of the natural resources, as a consequence of which the Spray Lakes issue was shelved. Now the matter of power development rests entirely with the province and it is expected that the Spray Lakes scheme will become a very live issue again.

Relief for B. C.

Following a week of steady precipitation the Coquitlam and Stave-Alouette storage reservoir, which supply water for the generation of power for the British Columbia Electric Railway Company's lower mainland system, have risen for the first time since Oct. 21, 1929.

The increase came at the end of the week of Dec. 15 and was caused mainly by mild weather following fairly extensive snow and rain falls earlier in the week. Previous to this the lakes had touched the lowest levels in the history of the province. On Coquitlam Lake the water had fallen to a point 64.5 ft. below the crest of the spillway; Stave Lake was 31 ft. below the crest, while Alouette Lake was 49.3 ft. below high mark.

Gatineau Power Company of Ontario, a subsidiary of the International Paper & Power Company, has eighteen hydro-electric plants on the Gatineau and other rivers of an aggregate designed capacity of 725,100 horse-power.

Dearborn Chemical Company Opens New Laboratories

During the week of Dec. 16 the Dearborn Chemical Company of Chicago held open house, welcoming, in a series of dinner meetings, old-time friends and customers, including many prominent power plant engineers. The occasion was the official opening of the company's new laboratories.

Occupying the entire second floor of building No. 2, the new laboratory comprises a main laboratory a room measuring approximately 50 x 100 ft., eight smaller private or classified laboratory rooms, a receiving room, store room, three executive offices and a library. The main laboratory is thoroughly equipped for complete water analysis and research and the eight smaller rooms are specially fitted for coal analysis, oil testing, factory control work, bacteriological examinations and special work. There is a small experimental boiler capable of operation up to 500-lb. pressure, from which samples can be removed and into which water and chemicals can be forced at any time. It is heated by horizontal electrical elements similar in location to boiler tubes.

Coming Conventions

American Society of Mechanical Engineers. Fiftieth Anniversary Celebration at New York City, Hoboken, N. J., and Washington, D. C., April 5-9, 1930. Semi-Annual meeting at the Hotel Book-Cadillac, Detroit, Mich., June 9-12, 1930. Secretary, Calvin Rice, 33 West 39th St., New York City.

American Institute of Electrical Engineers. Annual winter convention at New York, N. Y., Jan. 27-31, 1930. F. L. Hutchinson, secretary, 33 West 39th St., New York City.

American Society of Heating & Ventilation Engineers. Annual meeting in Philadelphia, Pa., Jan. 27-30, 1930, at the Benjamin Franklin Hotel. Secretary, A. V. Hutchinson, 33 W. 39th St., New York City.

Canadian Electrical Association. Annual Convention at the Manoir Richelieu via the S.S. "St. Lawrence," June 11-13, 1930. Secretary, H. M. Lyster, 405 Power Building, Montreal, Quebec.

Engineering Institute of Canada. Annual meeting at the Chateau Laurier, Ottawa, Ont., Feb. 12-14, 1930. Secretary, R. J. Durley, 2050 Mansfield St., Montreal, Que.

International Heating & Ventilating Exposition. Commercial Museum, Philadelphia, Pa., Jan. 27-31, 1930. Manager, C. F. Roth, Grand Central Palace, New York City.

International Congress for General Mechanics at Liege, Belgium, Aug. 31 to Sept. 7, 1930. For information address Alb. Schlag, 4 Place Saint-Lambert, Liege, Belgium.

National Electric Light Association. Annual convention at Municipal Auditorium, San Francisco, Calif., June 16-20, 1930. Secretary, A. J. Marshall, 420 Lexington Ave., New York City.

National Marine Engineers' Beneficial Association. Annual convention at Hotel Barlum, Detroit, Mich., the week of Feb. 10, 1930. Secretary, A. L. Jones, 9th St. and Mount Vernon Place, N. W., Washington, D. C.

New England States Association of the National Association of Power Engineers. Annual convention and exhibition of power machinery at the State Armory, Salem, Mass., June 19-20, 1930. Secretary, E. S. Daniels, 113½ Bridge St., Salem, Mass.

Obituary

Major James F. Case, well-known engineer and head of the Paris office of Stone & Webster, died suddenly Dec. 14 at the Hotel Grosvenor, New York, in his sixty-second year. A native of Wisconsin and a graduate of the University of Wisconsin, Major Case had engaged in varied activities which took him to many parts of the world, including the Philippines, where he was director of public works for several years. He joined Stone & Webster in 1928 as head of the Paris office.

Charles Rummel, for the past fourteen years manager of the light and power department for the British Columbia Electric Railway Company in the Fraser Valley area, including the cities of New Westminster and Chilliwack, died recently in Burnaby, B. C., at the age of 61 after a prolonged illness. Mr. Rummel joined the organization of the predecessor of the present British Columbia Electric Railway Company as a clerk in 1892, at a time when the entire office staff numbered three.

E. H. Pearson, New York district manager of the Electric Machinery Manufacturing Company, died suddenly on the morning of Dec. 7. Mr. Pearson was born in Malmo, Sweden, on Sept. 10, 1893. His early life was spent in Sweden, and he received some of his technical education at the Institute of Technology in Malmo. On coming to Minneapolis, he started work with Crown Iron Works as an electrician. Here he continued his technical education at the Dunwoody Institute in Minneapolis. In 1916, Mr. Pearson entered the employ of Electric Machinery Company as a service engineer for the Minneapolis district, which job he held until the fall of 1920. In the fall of 1921, he entered the sales organization of the company at New York, which position he held until the fall of 1928, when he was made manager of the New York district office. Mr. Pearson was a member of the American Society of Refrigeration Engineers, the American Society of Swedish Engineers of Brooklyn, N. Y., and the American Institute of Electrical Engineers.

R. F. Leefeld, superintendent of electrical generation for the Los Angeles Gas & Electric Corporation, Los Angeles, Calif,. died in that city Dec. 9. A native of Wisconsin, Mr. Leefeld came to California as a young man and at one time was employed by one of the electric railway companies in Los Angeles. From 1909 to 1916 he was chief engineer for the Temescal Water Company at Corona, Calif. For the two years following this he was associated with the Corona Foothill Lemon Company as a Diesel engineer, and from June, 1918, to September, 1919, he was in the employ of the Southern Sierras Power Company. During the next two years he served the Arizona Power Company as chief engineer at Clarksdale, Ariz., and then on Aug. 29, 1921, he joined the Los Angeles Gas and Electric Corporation, taking the position he held at the time of his passing.

Personals

J. B. Arthur has been appointed mechanical engineer of the Humble Oil & Refining Company, Houston, Texas. Mr. Arthur was formerly in the employ of Stone & Webster, Inc., and since September, 1928, has been assistant to the chief electrical engineer of Charles H. Tenney & Company, Boston, Mass.

Dr. William E. Wickenden, president of Case School of Applied Science, was tendered a dinner on Dec. 16 at the Hotel Winton in Cleveland by members of the Cleveland Engineering Society and the Cleveland Section of the American Society of Mechanical Engineers. Many notables of Ohio were present to do honor to Dr. Wickenden and hear his address on "Training Engineers for Positions of Responsibility."

Ray M. Hudson, assistant director of the National Bureau of Standards in charge of commercial standardization, has resigned to assume the duties of secretary of the Massachusetts Division of the New England Council, with headquarters in Boston, Mass.

Edwin E. Dresse, chief engineer of the Lincoln Electric Company, Cleveland, Ohio, has been appointed professor of electrical engineering at Ohio State University, effective Jan. 1.

Charles M. Nuckolls has resigned his position with the International Harvester Company of Chicago to accept a position with H. D. Conkey & Company, Mendota, Ill. He will take charge of the design and development work in the crane department of the Conkey organization.

F. H. Long, of the power plant department of the Milwaukee Electric Railway & Light Company, was recently awarded second prize by the company's technical league for his

paper entitled "The Use of Soap to Improve Turbine-Generator Air Washer Efficiency." J. F. Hickey, of the electrical distribution department, received third prize for his paper on "Steel Forms for Underground Steam Heating Duct."

CHESTER N. CHUBB, president of the Iowa-Nebraska Light & Power Company, Lincoln, Neb., has gone abroad to spend a year in research work in the interests of the United Light & Power Company.

H. E. CARTER, superintendent of the electric operating department of the Southern Public Utilities Company at Winston-Salem, has been transferred to the engineering and construction department of the general office at Charlotte.

RUSSELL J. HAYWARD, of the production department at the Detroit Edison Company's Delray station, is now in the planning, testing and service standards division of the company. ROBERT W. HOLDEN, of the drafting and surveying department of the same company, has been transferred to the engineering department. ROBERT TABB, has been transferred from the Detroit company's construction department to its central heating division.

BUSINESS NOTES

NEILAN, SCHUMACHER & COMPANY, Los Angeles, Calif., have appointed R. B. Werey representative in the New York territory to relieve William S. Waldrip, chief engineer of the company, who has been at the New York office for the past several months. Mr. Werey was formerly design engineer with the M. W. Kellogg Company.

EDWARD VALVE & MANUFACTURING COMPANY, East Chicago, Ind., is now represented in the Southeastern states by Neville & Cleary, Inc., Candler Bldg., Atlanta, Ga. This is the territory formerly covered for the company by the late W. J. Neville.

GILLETTE-VIBBER COMPANY, New London, Conn., has appointed J. W. Himmelsbach as its representative in the Chicago district, with offices in the Engineering Bldg., 205 West Wacker Drive.

C. J. TAGLIABUE MANUFACTURING COMPANY, Brooklyn, N. Y., will open on Jan. 1, 1930, a branch factory at 417 Lake St., Shreveport, La., to serve the Southwestern states. C. L. Huffman, district manager of the territory, will have charge of the new factory.

ROBERT J. TORRENS is opening an office at 630 Shubert Bldg., St. Paul, Minn., for the practice of consulting engineering in the field of steam and electricity.

LEEDS & NORTHRUP COMPANY, Philadelphia, Pa., held a minstrel show and dance at the Elks Club in Philadelphia on Dec. 13 to celebrate the opening of an addition to its plant, which during the last year has doubled in size.

TRADE CATALOGS

TRANSFORMERS — General Electric Company, Schenectady, N. Y., has recently published an extensive catalog, No. GEA-607A, of distribution transformers. Well illustrated, this 80-page booklet contains valuable data on transformers applicable to many distribution services. Another recent bulletin of the company, No. GEA-77C, describes capacitors for power-factor correction.

GAGES—Combustion instruments for recording CO_2, draft, flue-gas temperature, steam pressure and temperature are described and illustrated in a 20-page catalog, No. PGK-29, recently issued by the Hays Corporation, East 8th St., Michigan City, Ind.

PIPING—A complete line of cast iron, malleable iron and electric cast steel pipe fittings are listed in a new 359-page vest-pocket catalog of the Stockham Pipe & Fittings Company, Birmingham, Ala. Over 7,500 different fitting patterns are included in the book, as well as much dimension data that should aid in estimating the fittings for any job.

CHAINS — Link-Belt Company, Indianapolis, Ind., has just published a new roller chain data book, No. 1257, which it claims is the most complete which they claim is the most complete manual for selecting and applying chain yet developed. This 96-page book illustrates the construction of chains and wheels, and presents many applications of chain on light and heavy-duty industrial drives.

TEMPERATURE REGULATION — Three bulletins have just been published by the Fulton Sylphon Company, Knoxville, Tenn., on automatic temperature control of liquids, air, gases or vacuum.

COOLING TOWERS—"Streams of Gold" is the title of a little booklet recently issued by the Edwin Burhorn Company, Foot of West 5th St., Bayonne, N. J., which describes and illustrates cooling tower installations.

SWITCHBOARDS—Outdoor and truck-type switching equipment is illustrated and described in bulletins A-06812 and A-06813 of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. A 28-page booklet, A-06816, on standard and heavy duty busbar supports has also been recently issued by the company.

POWER—Byproduct power is simply and cleverly discussed in the form of a popular engineering lecture in a booklet recently issued by Mashinenfabrik Buckau R. Wolf A-G, Magdeburg, Germany. Well illustrated, this 17-page bulletin is written in English.

FUEL PRICES

COAL

The following table shows the trend of the spot steam market in various coals, f.o.b. mines; mine run, except Pittsburgh gas slack:

Bituminous (Net Tons)	Market Quoting	Price per Ton
Navy Standard	New York	2.25 @$2.50
Kanawha	Columbus	1.30 @ 1.60
Smokeless	Cincinnati	2.00 @ 2.25
Smokeless	Chicago	2.00 @ 2.25
S. E. Kentucky	Chicago	1.30 @ 1.60
Steam	Pittsburgh	1.50 @ 1.75
Gas Slack	Pittsburgh	1.00 @ 1.20
Big Seam	Birmingham	1.25 @ 1.50
Anthracite		
(Gross Tons)		
Buckwheat	New York	$2.75@$3.00
Barley	New York	1.40@ 1.50

FUEL OIL

New York—Dec. 19, f.o.b. Bayonne, N. J., 28@34 deg., Baumé, industrial use, tank-car lots, 4.75c. per gal.; f.o.b. Bayway, 36@40 deg., furnace, tank-car lots, 6c. per gal.

St. Louis—Dec. 12, tank-car lots, f.o.b. St. Louis, 24@26 deg., $1.695 per bbl., or 42 gal.; 26@28 deg., $1.745 per bbl.; 28@30 deg., $1.795 per bbl.; 30@32 deg., $1.845 per bbl.; 32@36 deg., gas oil, 4.526c. per gal.; 37@40 deg., distillate, 5.73c. per gal.

Pittsburgh—Dec. 11, f.o.b. local refinery, 30@34 deg., fuel oil, 5c. per gal.; 36@40 deg., 5.25c. per gal.

Philadelphia—Dec. 13, 13@19 deg., $1.05@$1.10 per bbl. or 42 gal.; 22 deg. plus, $1.575@$1.625 per bbl.; 23@27 deg., $2.10@$2.15 per bbl.

Cincinnati — Dec. 10, tank-car lots, f.o.b. local refinery, 24@26 deg. Baumé, 5.25c. per gal.; 26@30 deg., 5.5c. per gal.; 30@32 deg., 5.75c. per gal.

Chicago—Dec. 11, tank-car lots, f.o.b. Oklahoma, freight to Chicago, 90c. per bbl. or 42 gal.; 22@26 deg., 85@90c. per bbl.; 26@30 deg., $1.02½@$1.07½ per bbl.; 30@32 deg., $1.22½ per bbl.

Boston—Dec. 16, tank-car lots, f.o.b., 12@14 deg., Baumé 4.25c. per gal.; 28@32 deg., 5.4c. per gal.

Dallas—Dec. 14, f.o.b. local refinery 26@30 deg., $1.35 per bbl. or 42 gallons.

New Plant Construction

COMPILED BY THE MCGRAW-HILL BUSINESS NEWS DEPARTMENT, WHICH IS PREPARED TO FURNISH A MORE COMPLETE DAILY SERVICE TO THOSE WHO WISH IT

Ark., Morrilton—City is having plans prepared for the construction of a power plant with either oil or steam engines. Burns & McDonnell Engineering Co., 401 Interstate Bldg., Kansas City, Mo., is engineer.

Calif., San Diego—Bd. of Supervisors, plans the construction of a sewer system in Mission Valley including sewage treatment plant and pumping station. Estimated cost $500,000.

Connecticut and Massachusetts — National Service Co., 150 Congress St., Boston, Mass., is having plans prepared for the construction of ice plants at New London and Hartford, Conn., also at Somerville and Worcester, Mass. Estimated cost to exceed $40,000 each. R. B. Engineering Co., 11 West 42nd St., New York, N. Y., is engineer.

D. C., Washington—Potomac Electric Power Co., 14th and C. Sts., N. W., plans the construction of a power generating plant. Estimated cost $2,500,000. Stone & Webster, 49 Federal St., Boston, Mass., are engineers.

Ill., Chicago—**Hooper & Janusch, 879 North State St., Archts., will receive bids in January for a 19 story apartment building at 545 Barry Ave. for A. Wirtz, 3152 Sheridan Rd. Estimated cost $1,000,000.**

Md., Baltimore — Johns Hopkins Hospital, Washington and Monument Sts., awarded contract for the construction of an 8 story hospital to Consolidated Engineering Co., 20 East Franklin St. Estimated cost $1,000,000. Steam heating system, etc. will be installed.

Md., Baltimore—Investment Construction Co., c/o L. T. Rouleau, Investment Bldg., Washington, D. C., Archt., plans the construction of an 8 story apartment building including steam heating sysetem, etc. at 108-114 West University Parkway. Estimated cost $1,000,000. W. Canter & Associates, Knickerbocker Bldg., Baltimore, are associate architects. Work will be done under the supervision of owner.

Md., Baltimore—Mottu & White, 527 North Charles St., Archts., will receive bids until Jan. 7 for the construction of an 8 story office building including steam heating system, etc. at Saratoga and Charles Sts for Baltimore Life Insurance Co., 17 West Saratoga St. Estimated cost $700,000.

Mass., Brookline—Sunshine Laundry Co., 8 Flora St., awarded contract for addition and alterations to boiler room to J. Driscoll & Son, 94 Washington St.

Mich., Howell—State of Michigan, Michigan State Sanitarium, Lansing, plans the construction of a group of hospital buildings including steam heating system, boilers, elevators, etc. here. Estimated cost $1,000,000. Malcolmson & Higginbotham, 1219 Griswold St., Detroit, are architects.

Mich., Pontiac—Bd. of Supervisors, Oakland County, will receive bids until Dec. 30 for the construction of a 1 story power house including coal and ash handling equipment for unit of hospital group on Cooley Lake Rd. F. D. Madison, Royal Oak, is engeneer.

Minn., St. Paul—**First National Bank, 346 Jackson St., is having plans prepared for the construction of a 30 story bank and office building including steam heating system, etc. at 4th St. between Cedar-Minnesota Sts. Estimated cost $3,000,000. Graham, Anderson, Probst & White, 80 East Jackson St., Chicago, Ill., are architects.**

Mo., St. Louis — Pretoria Realty Co., c/o Henri Rush & Co., 6038 Delmar Blvd., Archts., is having revised sketches made for the construction of a 15 story hotel at Delmar Blvd. and Des Peres Ave. Estimated cost $2,000,000.

Mo., St. Louis—Albert Wenzlick Real Estate Co., 1010 Chestnut St., awarded contract for the construction of a 42 story office building at 11th and Chestnut Sts. to Humes-Deal Co., 777 Arcade Bldg. Estimated cost $3,000,000.

N. J., Hackensack—Cedar Tree Estates Inc., 20 East Palisade Ave., Englewood, will soon award contract for the construction of a 5 story apartment building, etc. including steam heating system, etc. here. Estimated cost $800,000. H. O. Hamilton Corp., 369 Lexington Ave., New York, N. Y., is architect.

N. J., Hackensack—Corp., c/o R. E. Hall & Co. Inc., 342 Madison Ave., New York, N. Y., is having preliminary plans prepared for the construction of an 8 story hotel including steam heating system, etc. at Anderson St., Pangborn Pl. and Maple Ave. Estimated cost $750,000.

N. J., Jersey City—W. Neuman, 26 Journal Sq., Archt., will receive bids until Feb. 1 for the construction of a 15 story office and stores building including steam heating and ventilation systems, boilers, elevators, etc. at Oakland and Newark Aves. for Springarn Realty Co., J. Springarn, Pres., 591 Summit Ave. Estimated cost $750,000.

N. J., New Brunswick—J. L. Mott, 31 Morgan Ave., Brooklyn, N. Y., is having plans prepared for the construction of a 14 story office building including steam heating and ventilation systems, boilers, elevators, etc. on Livingston Ave. here. Estimated cost $1,000,000. G. E. Fulton, Jr., 19 West 44th St., New York, N. Y., is architect.

N. Y., Lynbrook—Knickerbocker Ice Co., 41 East 42nd St., New York, plans the construction of an ice plant at Merrick Rd. here. Estimated cost $60,000. A. A. Abrams, Lynbrook, is engineer.

N. Y., New York—Home for Incurables, O. L. Mills, Pres., 3rd Ave. and 183rd St., plans the construction of a dormitory and power and heating unit. Estimated cost $500,000. Crow, Lewis & Wick, 200 5th Ave., are architects.

N. Y., Riverdale — New York Central R.R., 466 Lexington Ave., New York, will soon award contract for the construction of a remote control sub-station here. Estimated cost to exceed $40,000. F. B. Freeman, New York, is chief engineer.

N. Y., St. George (sta. Staten Island)—Dept. of Parks, New York, plans the construction of a boiler room, shops, etc. at Slosson and Drake Aves. here. Estimated cost $50,000. Sibley & Fetherstone, 205 East 42nd St., New York, are architects.

N. Y., Willard—Dept. of Mental Hygiene, Albany, will receive bids until Jan. 15 for addition and alterations to power plant including new boiler and stoker, etc. at Willard State Hospital, here.

O., Cincinnati—L. B. Harrison Estate, First National Bank, plans the construction of a 5 story hotel on McMillan St. Estimated cost $1,000,000. S. Hannaford & Sons, Dixie Terminal, are architects.

O., Cleveland—Owners Investment Co., c/o W. J. Austin, of The Austin Co., 16112 Euclid Ave., Gen. Contrs., is having plans prepared for a 12 story, medical office building East 105th St. and Carnegie Ave. Estimated cost $1,500,000. Private plans.

O., Toledo—City awarded contract for the construction Bay View Park Sewage Treatment Works, Contr. 21 to A. Bentley & Sons, Belmont Ave. Estimated cost $1,113,000. Equipment including diaphragm pumps not purchased.

Okla., Cushing — **Empire Pipe Line Co., Bartlesville, plans the construction of an oil pipe line, also pumping plant near here. Estimated cost $35,000. Private plans.**

Okla., Hulbert—Public Service Co., 510 South Boston St., Tulsa, plans the construction of a new steam power plant here. Estimated cost $100,000.

Tex., El Paso — City is having preliminary surveys made for the construction of a hospital including boiler plant and steam heating system, laundry plant including complete equipment. Estimated cost $1,000,000.

Tex., Paris—City plans an election to vote $70,000 for the installation of a municipal ice plant.

Wis., Milwaukee—Fox Theatres Inc., c/o C. H. Crane, Fox Bldg., Woodward Ave., Detroit, Mich., Archt., is having plans prepared for the construction of an 8 story theatre and office building, including steam heating and ventilation systems, boilers, elevators, etc. on Wisconsin Ave. here. Estimated cost $4,000,000.

B. C., Victoria—British Columbia Electric Railway Co. Ltd., awarded contract for water wheel and generator 15,000 hp. for 4th unit of Jordan River hydro-electric plant to English Electric Co. of Canada, 1140 Hamilton St., Vancouver, $160,000; transformers to Canadian Westinghouse Co. Ltd., 602 Hastings St. W. Vancouver, $55,000; 48 to 60 in. steel penstock 5,250 ft. long to Vancouver Engineering Works Ltd., 510 6th Ave. W., Vancouver, $386,000.

Ont., Toronto—**H. Greenberg Ice Co., 724 Queen St., awarded contract for the construction of an ice plant on Wolseley St. to A. Greenspoon, 296 Dundas St. W.**

Equipment Wanted

Operating Units—Chicago, Ill.—Sanitary District of Chicago, R. A. Woodhull, Chn., will receive bids until Jan. 2 for furnishing and installing five electric motor gate valve operating units together with necessary wiring, piping, controlling equipment, etc. for North Branch Sewage Pumping Station, Lawrence Ave.

Pumping Equipment—La Porte, Tex.—City plans to purchase pumping equipment, etc. for proposed waterworks improvements. Estimated cost $15,000.

Pumps, Etc.—Flint, Mich.—City plans to purchase electrically operated pumps, etc. for proposed waterworks system. Estimated cost $1,500,000.

Pumps, etc. — Windsor, Ont. — Essex Border Utilities Comn., Murray Bldg., plans to purchase centrifugal pumps, additional filters, etc. for proposed waterworks filtration plant.

Pumps and Motors — Waurika, Okla. — City plans to purchase four turbine type well pumps and motors for proposed waterworks system. Estimated cost $52,500.

Transmitters, Etc.—Wellington, N. Z.—Post & Telegraph Dept., will receive bids until Jan. 27 for seventy-five transmitters, breastplate without cord or plug, B. P. O. type 4 or equivalent substitute; also until Feb. 3 for 3,000 pairs blocks for use in B.P.O. type protectors; until Feb. 5 for 500 fuses indicator alarm, 1-2 amps. 1,000 fuses indicator alarm 2-85 amps.; and until Feb. 13 for 2,500 lamp opal caps B.P.O. type.

Industrial Projects

Calif., Compton—Pacific Iron & Steel Co., 241 East Ave. 26, is having plans prepared for the construction of a 1 story, 400 x 700 ft. factory at South Alameda St. and Lynwood Rd. Estimated cost $500,000. P. and W. S. Davis, 3215 West 6th St., are architects.

Ill., Danville—C. M. Lewis, Adams Blvd., Archt., will receive bids in January for the construction of a 1 story factory for Electric Coal Mining Machine Co., 309 St. Johns Court, Chicago.

Ind., Fort Wayne—General Electric Co., 1635 Broadway, awarded contract for the construction of a 6 story, 80 x 140 ft. factory on Wall St. to M. Irmscher & Sons, 1113 First National Bank Bldg. Estimated cost $267,000.

Mich., Detroit—Chicago Pneumatic Tool Co., 401 East Larned St., is having plans prepared for the construction of a 2 story, 75 x 80 ft. tool factory and office on East Larned St. Estimated cost $50,000. Van Leyen, Schilling & Keough, 3440 Cass Ave., are architects.

Mich., Detroit—Iodent Chemical Co., 1011 Lafayette Blvd., is having plans prepared for the construction of a 2 story tooth paste factory on Lafayette Blvd. Estimated cost $200,000. Private plans. Machinery and equipment will be required.

Mo., St. Louis—**J. R. Brockman Mfg. Co., 617 North 2nd St., plans the construction of a 1 story, 200 x 400 ft. pipe manufacturing plant at 3806-16 Market St. Architect not selected.**

N. J., Newark—Positive Lock Washer Co., Ave. A., awarded contract for a 2 story addition to factory at Ave. A. and Miller St. to W. J. MacEvoy Construction Co., 85 Academy St. Estimated cost $40,000.

N. J., Newark—Siegler & Greenberg, 164 Market St., Archts., will receive bids about Mar. 1 for the construction of a 6 story, 68 x 120 ft. factory for the manufacture of radio tubes at 78-82 8th Ave. for Sonatron Tube Co., 57 State St. Estimated cost $175,000.

Pa., Philadelphia—Bachman Bros, Inc., 609 Commerce St., awarded contract for the construction of a 2 story, 110 x 220 ft. celluloid factory at Erie and M. Sts. to A. R. Raff Co., 1635 West Thompson St. Estimated cost $200,000.

Pa., Philadelphia — C. J. Webb Co., 116 Chestnut St., will soon award contract for the construction of a 2 story, 101 x 185 ft. textile factory at D and Erie Sts. Estimated cost $225,000. C. E. Wunder, 1520 Locust St., is architect.

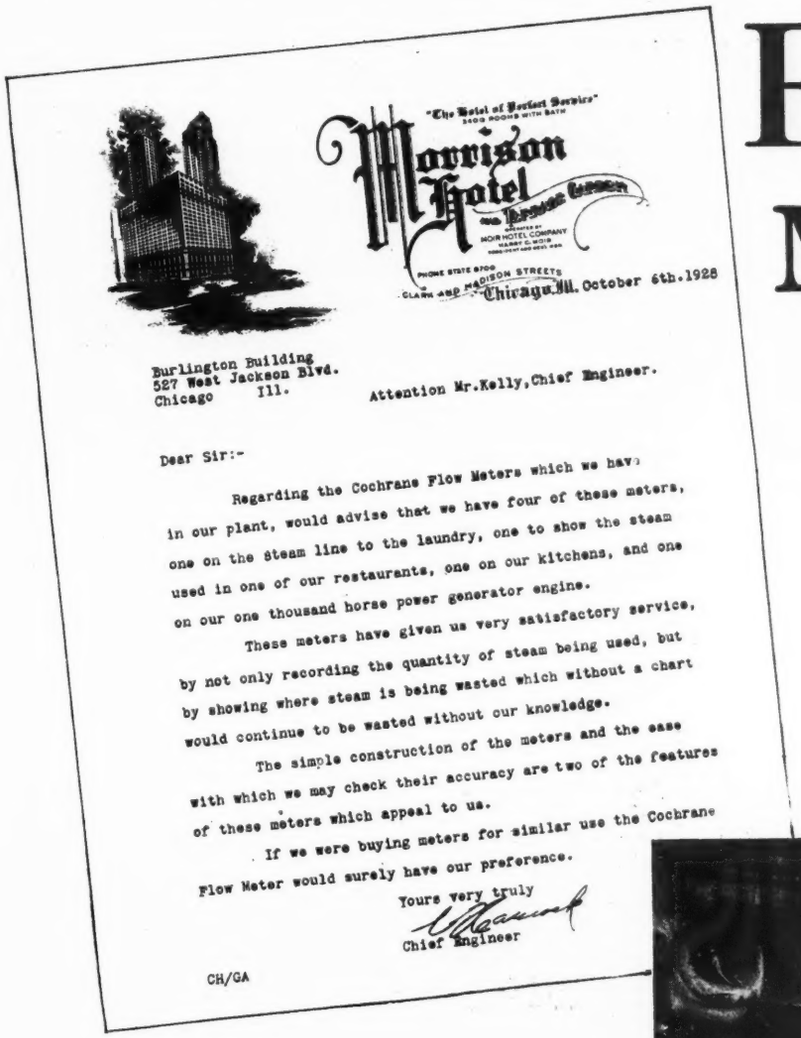
Tenn., Jackson — American Creosote Works, Inc., 1305 Dublin St., New Orleans, La., will receive bids early in Jan. for the construction of a creosote plant including power plant, engine room equipment, two high pressure creosoting cylinders, 8 x 150 ft. together with the necessary tram cars, etc. here.

Wis., Kenosha—Snap-On Wrench Co., 14 East Jackson Blvd., Chicago, Ill., manufacturers of automobile wrenches, awarded contract for the construction of a 1 story factory here to P. Ploskee, Kenosha. Estimated cost $400,000.

Ont., Sandwich—Sandwich Foundry Ltd., 400 Bloomfield St., is having plans prepared for the construction of a 1 story foundry on Bloomfield St. Estimated cost $250,000. Private plans. Cupolas and general foundry equipment will be required.

Que., Montreal—Dominion Bridge Co. Ltd., Dominion Station Lachine, plans addition to plant to increase output 2,000 ton daily on Notre Dame St. E., also plans a new plant at Weston, Ont. Estimated cost $100,000 and $200,000 respectively.

COCHRANE FLOW METERS *PAY*



"The Hotel of Perfect Service"
600 ROOMS WITH BATH

Morrison Hotel

PHONE STATE 8700
CLARK AND MADISON STREETS

Chicago, Ill. October 6th. 1928

Burlington Building
527 West Jackson Blvd.
Chicago Ill.

Attention Mr. Kelly, Chief Engineer.

Dear Sir:-

Regarding the Cochrane Flow Meters which we have in our plant, would advise that we have four of these meters, one on the steam line to the laundry, one to show the steam used in one of our restaurants, one on our kitchens, and one on our one thousand horse power generator engine.

These meters have given us very satisfactory service, by not only recording the quantity of steam being used, but by showing where steam is being wasted which without a chart would continue to be wasted without our knowledge.

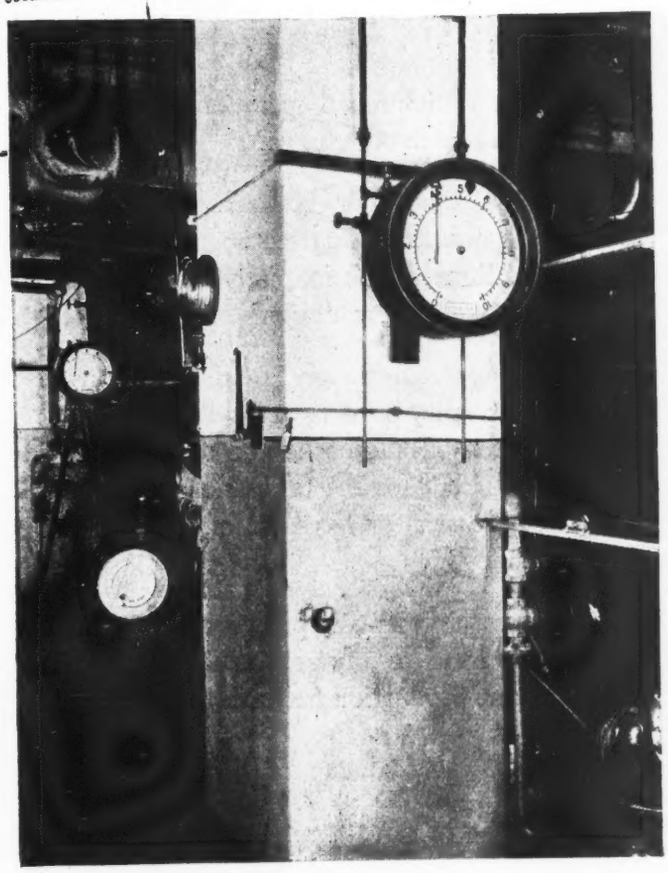
The simple construction of the meters and the ease with which we may check their accuracy are two of the features of these meters which appeal to us.

If we were buying meters for similar use the Cochrane Flow Meter would surely have our preference.

Yours very truly

Chief Engineer

CH/GA



FOUR Cochrane flow meters, two of which are shown, are used by the Morrison Hotel, Chicago. The one measuring steam used in the laundry has been instrumental in reducing the steam consumption in that department by 30%, saving not less than $2,000 per year, and further savings are expected.

Could you not use flow meters to advantage in your plant?

Ask for Bulletin L-680

COCHRANE CORPORATION,
17th and Clearfield Streets
PHILADELPHIA, PA.

480

My House Is In Order
George Edwards—Engineer

In the old Mosaic law provision was made for a period in each year that would be devoted to striking a balance in every man's affairs. As in all things related to the health and proper conduct of the people who adhered to it, this provision was prompted and written into the law by the experience of many wise men.

We are come now to the time in our year when, prompted only by tradition, we too strike balances in order that we may profit in the future both by errors and experience.

What have we done with the time and opportunities of the past year—what are we hoping to accomplish with them in the year to come?

Have we improved operation of the plants that may be in our charge?

What about our boilers? Do we still endure obsolete firing methods or have we adopted one of the infinitely more effective methods of modern design?

Are we still smugly satisfied to run an engine twenty or more years old because "it is written off the books and doesn't cost a cent" (except for the thousands of dollars a year it *wastes*) or have we modernized our prime movers?

Do we still scatter process steam with a careless hand to any and to every place in our plant production may ask for it, countenancing duplications and waste—or do we plan its distribution, and carefully measure and control the products we are making which are consumed by our departmental customers?

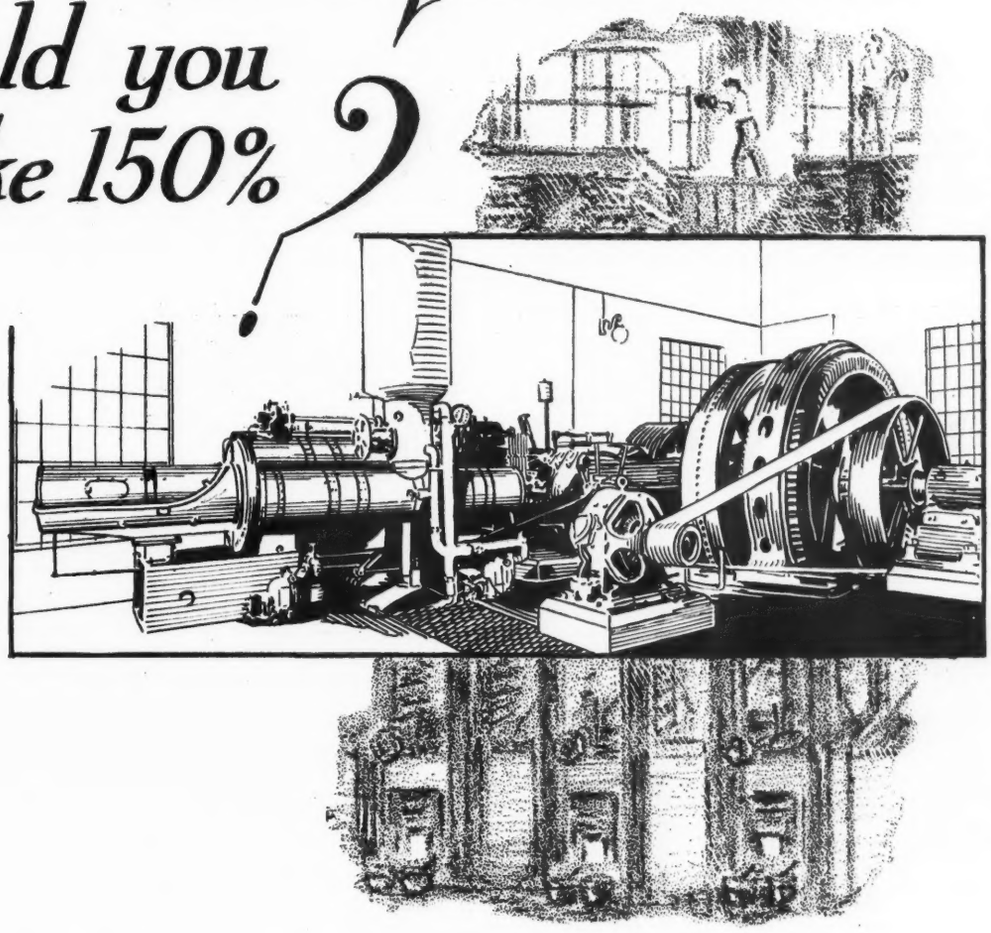
What have we done to improve our load factor? Our power factor—and have we made any progress in establishing an appreciation of the basic importance of this same power factor?

Have we improved our heat balance or does our curve still look like a torturous maze rather than a balance curve?

What about the myriad power services we constantly supply—are they being used effectively or wastefully? Are we supplying steam where hot water would do. Have we obtained satisfactory mileage from our elevator cables? Are our air and heat supply problems in step? Is our refrigerating load balanced?

These, and hundreds more, we can profitably ask ourselves. And when the answers are made, forget the past year—it has gone back to eternity—but remember them in every hour of the coming year. Plan to put the answers to these and the plans they suggest to work. Strike your balance and then devote yourself untiringly to reaching a new goal so that a year hence when you again ask what has been accomplished, you can answer, with utmost satisfaction: "My house is in order."

Where else in your business could you make 150%?



FORTUNATELY for a large glass company, the decrepit condition of their old engines made them decide to shut them down and purchase current at the rate of 1.35 cents a kilowatt-hour.

We say, FORTUNATELY, because we enabled them to make 150% on their cash investment. We made a survey of their plant and agreed to furnish them a Universal Unaflow Engine with generator which cost $31,620 cars destination, and take $30,000 of the cost in savings made possible by the new engine, as compared with the cost of purchased current. We do not believe their total expense for erection and connection items including foundations, was over $10,000.00.

The equipment is paying for itself at the rate of $1250 a month or $15,000 a year. This is another of the many cases which have proved that Universal Unaflow Engines installed under the Skinner Guaranteed Saving Contract bring greater returns to the users than the same amount of cash invested in their own business. In fact, the purchaser is so well pleased with the operation of this unit that he has contracted for a duplicate unit under the Skinner Guaranteed Saving Contract, for another glass plant.

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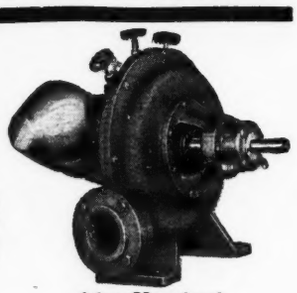

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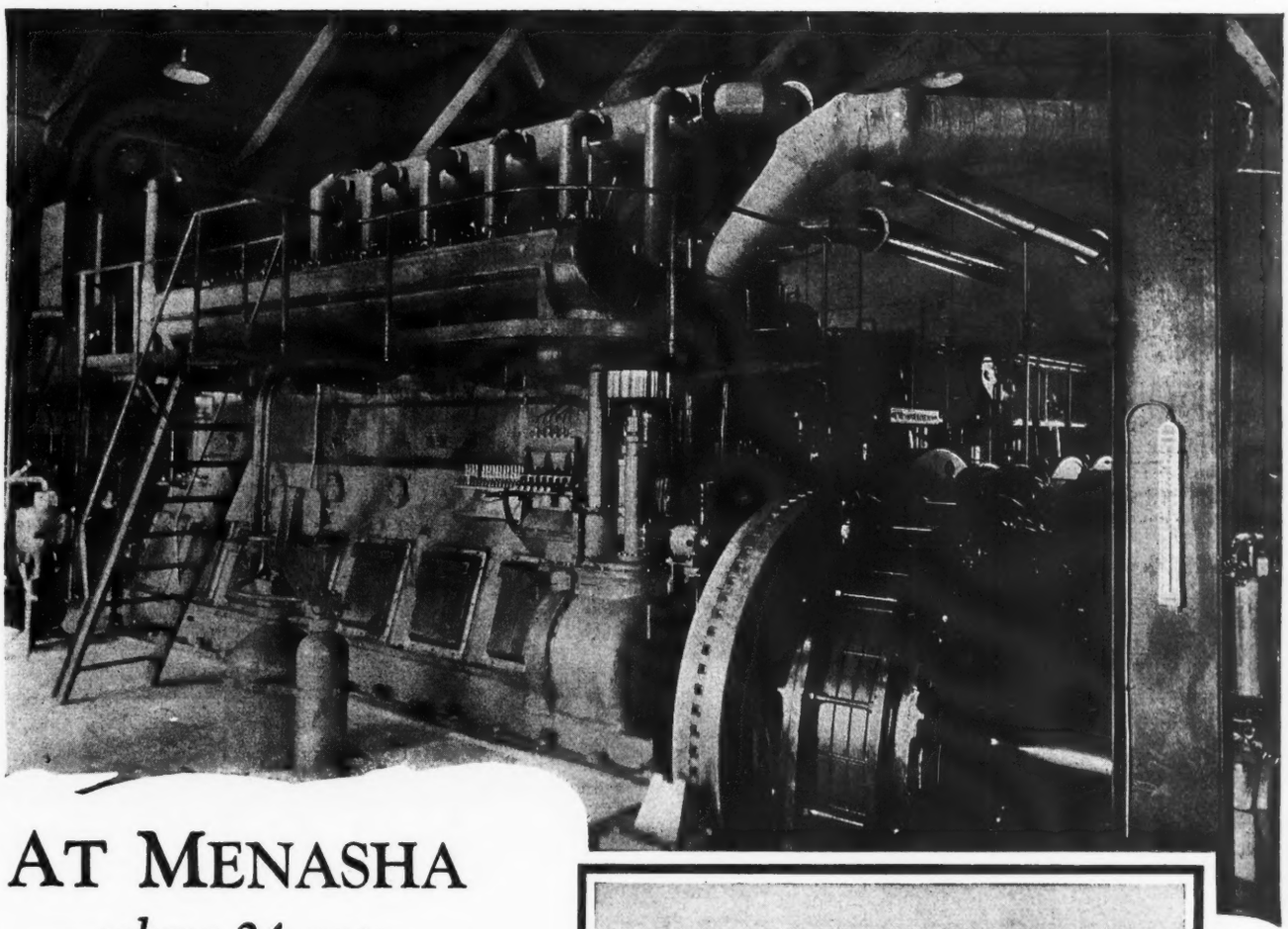
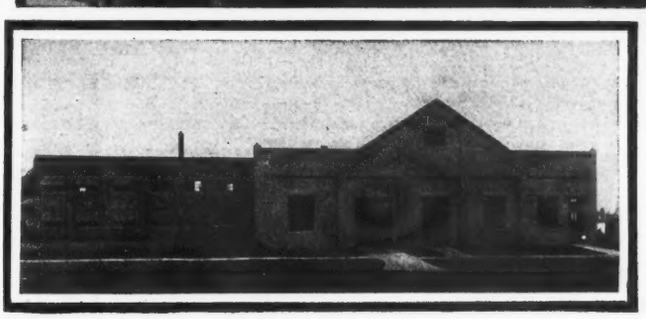


AT MENASHA

—where 24-year Diesel experience makes judgment dependable



ALTHOUGH one of the oldest in the country depending exclusively upon Diesel units as prime movers, the above Menasha, Wisconsin, plant installed its first McIntosh & Seymour Engine only three years ago. The superiority of this unit, of 600-hp. capacity, was confirmed in 1928 by an order for another twice as large.

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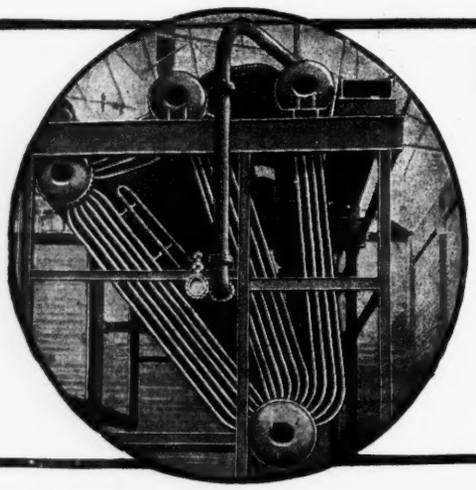

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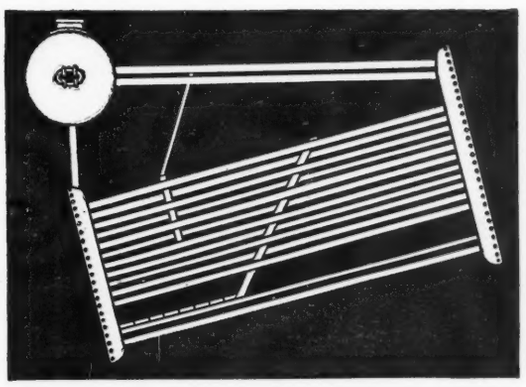

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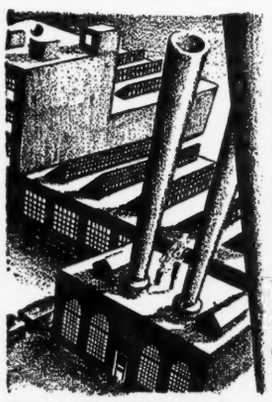

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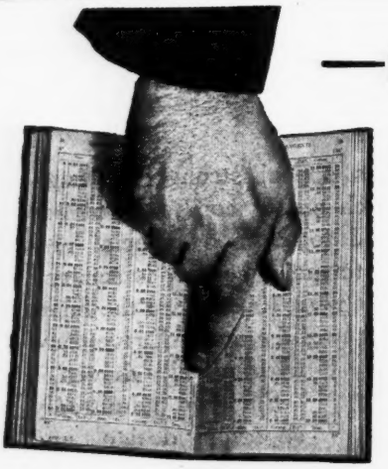
TUBES



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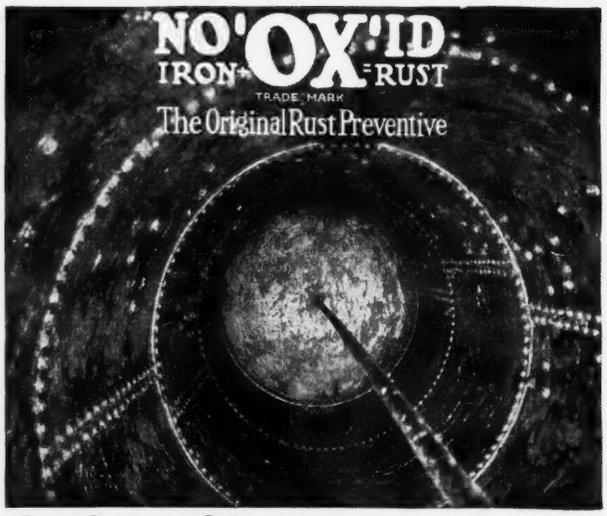

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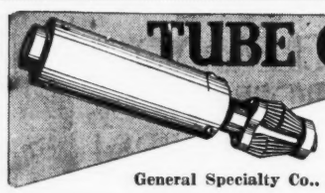

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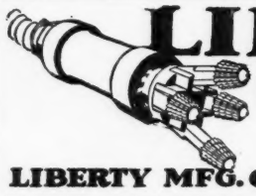

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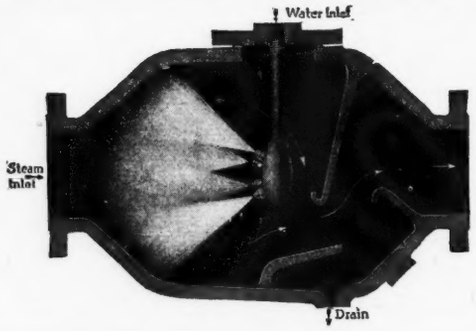

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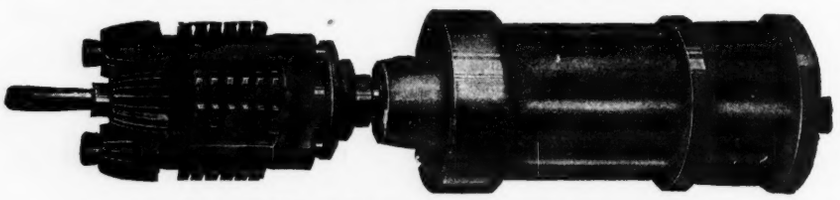
Four Cleanings a Year May Be Cheaper Than One

The average cleaning time per boiler is reduced by more frequent cleaning and more uniform efficiency of the boiler is maintained.



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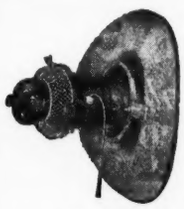

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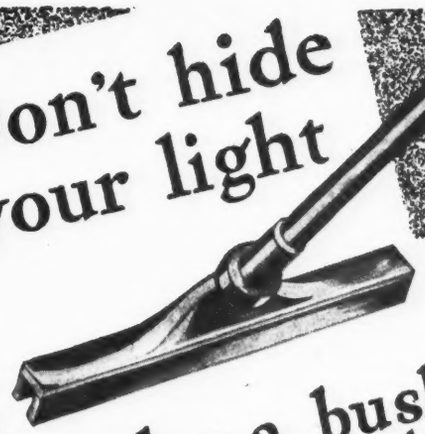

under a bushel of coal dust

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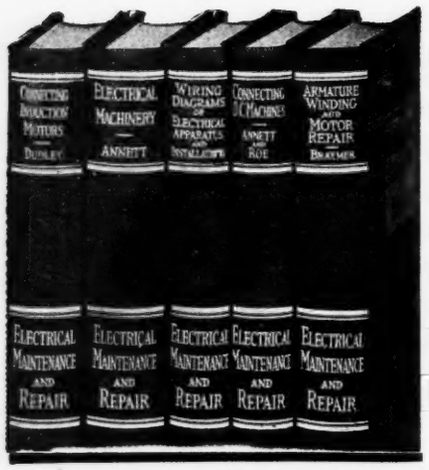
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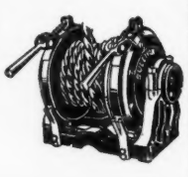

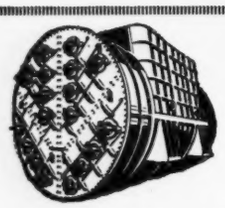

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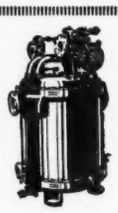

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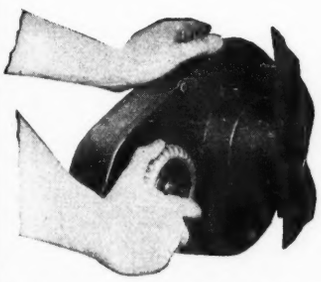

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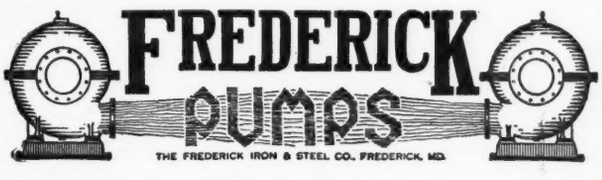

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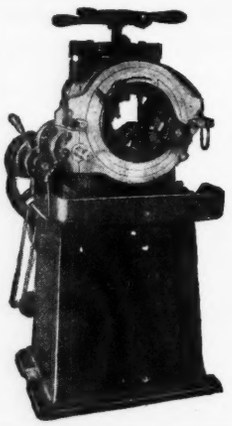

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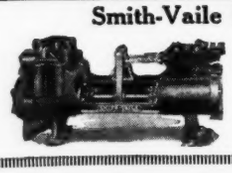

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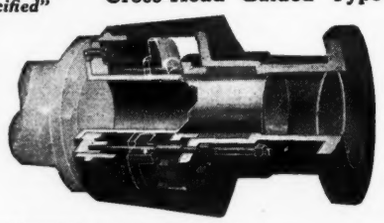

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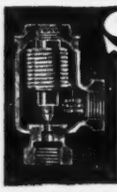

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Is self-adjusting at pressures from 0 to 100 lbs. Screws right into pipe line. Only one moving part. Costs about one-third the price of bucket or float traps. *Sold on 30 days' free trial. Booklet A-269 on request.*

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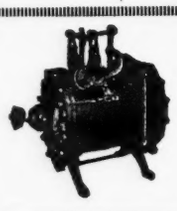

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Return Traps - Lifting Traps
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There is nothing to equal their simple and reliable operation

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There is an Armstrong Trap for every need

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Send for catalog!

District Representatives in 40 Cities

Armstrong Machine Works
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YES!

Please Send Catalog

Atlas Valve Co., 289 South St., Newark, N. J. Please send Catalog No. 21, Edition 2, on "Regulating Devices."

Name .....
Firm .....
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TRI-LOK

OPEN STEEL FLOORING
Triple locked under 1600 tons pressure

Manufactured by
THE TRI-LOK COMPANY
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DRAVO

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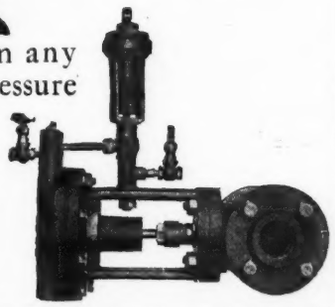

Will reduce from any pressure to any pressure in one reduction. It is also a dead end valve. *May we send catalog H-10?*

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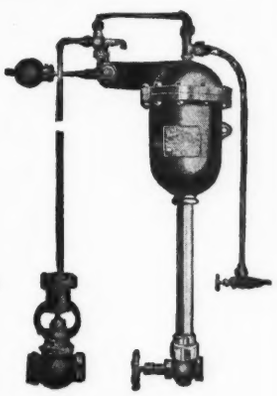
CF —always on the job



VIGILANT Feed Water Regulators, by maintaining the water level at *middle gauge*, preclude the danger of boiler explosions due to low water, or cylinder flooding due to high water.

Write for further details.

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28-40 Penn Avenue
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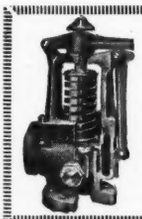
Also Manufacturers of the Fulton Pump Governor



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Quality Products for Discriminating Users
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Valve Reseating Machines
for Globe Valves—for Gate Valves—for Pump Valves
See the full page ad in the issue of Nov. 26
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10 East River St., Orange, Mass., U. S. A.

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VALVES
HYDRANTS
SLUICE GATES
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HOMESTEAD
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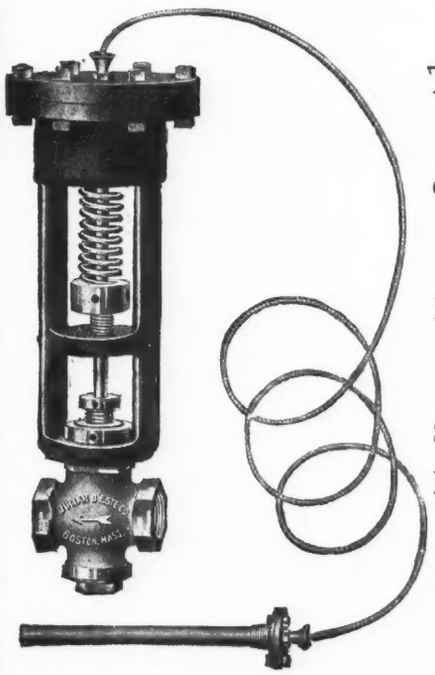
CORAOPOLIS ~ PENNA.

Write for full descriptive literature.

CURTIS ENGINEERING SPECIALTIES



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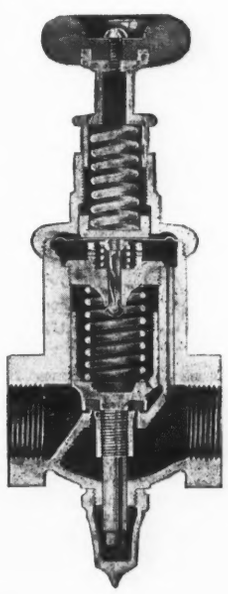
Quick response to temperature changes.

Minimum cost of installation and upkeep.

Self-contained.

No exterior operating medium required.

D'ESTE (Trademark)



Curtis Steam Regulator

Compact, self-contained and pilot actuated.

A positive and automatic pressure control for accurate regulation.

Send for General Catalogue No. 60 containing valuable engineering data.

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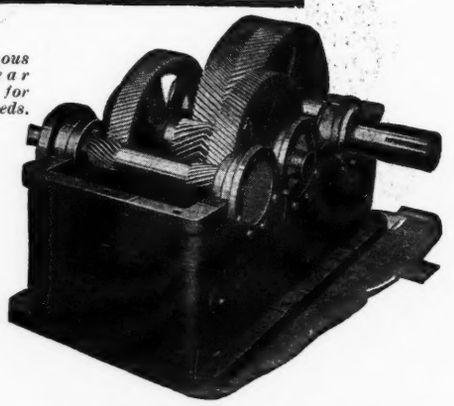
SPEED REDUCING UNITS
(ONE NAME-ALL TYPES)

Now Include "Continuous Tooth" Herringbone Gears

These Gears ("Sykes Type") having no gap at center, have greater strength, greater gear bearing surface, and make possible heavier loads at high speed. These Units are but one of the complete range of types we manufacture—Worm, Spur, Herringbone, Spiral Bevel Herringbone. For all drives; all ratios. In the Philadelphia Line you can get exactly the speed reducing unit best suited to your needs. We now also produce Ground Thread Worms for smoother, more uniform power transmission.

Philadelphia "Continuous Tooth" Herringbone Gear Speed Reducing Unit for heavy loads at high speeds.



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Manufacturers of Industrial Gears and Speed Reducing Units

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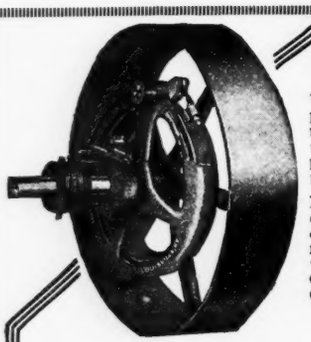

Pull Counts Here!

Where steady production depends upon continuous power, the reliable service of a Caldwell Friction Clutch is indispensable. It pulls—and that's the main object of a clutch.

But it pulls with the minimum of attention because the usual cause of clutch trouble—too many adjustments to be watched—does not exist in the Caldwell. One screw adjusts it. One lever controls it.

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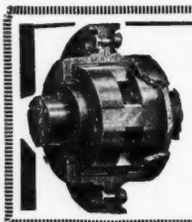
Caldwell FRICTION CLUTCHES

DODGE
MISHAWAKA
DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana
The World's Marketplace for Industrial Equipment



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Accessible, Noiseless, Simple, Interchangeable, Powerful, Durable
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REPUBLIC FLOW METERS

Automatic Temperature, Pressure and Safety Combustion Controls for industrial processes and industrial heating.

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SIMPLE—ACCURATE—DEPENDABLE
Write for Data
SIMPLEX VALVE & METER COMPANY
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For Hot Water Heaters—Factories, Offices, and Industrial Processes. Write for Bulletins to 2771 Greenview Ave., Chicago, or 137 E. 46th St., New York City.
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COMBUSTION INSTRUMENTS

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BOILER CONTROL PANELS

Ask for Bulletin

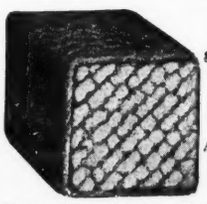
The Hays Corporation

MICHIGAN CITY, INDIANA

This name

Chesterton's No. 64 Packing

is on the genuine



Pat. Applied For

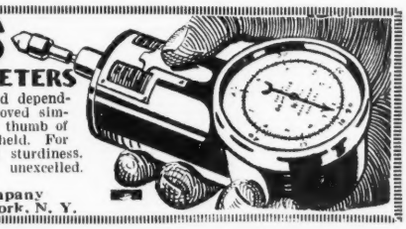
Meets all requirements of highest pressures and temperatures. Note diagonal arrangement of asbestos. Graphite between plys allows slippage and compressibility necessary for perfect packing.

Combination Brush and Scraper

Two boiler cleaning tools in one. Scraper edges stay sharp because they are hardened. The wire brush cleans the tube thoroughly, leaving a bright, clean surface.

A. W. Chesterton Co. or Advance Packing & Supply Co.
64 India St., Boston, Mass. 808 Washington Blvd., Chicago

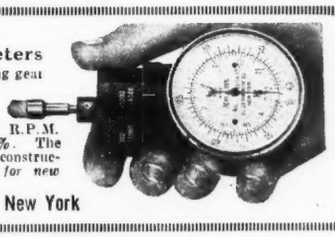
S & S HAND TACHOMETERS



Troubleproof, non-delicate and dependable. Speed change by approved simple gear shift, operated with thumb of hand in which tachometer is held. For accuracy, quick results, and sturdiness. S & S Tachometers are unexcelled. Particulars?

George Scherr Company
142 Liberty St., New York, N. Y.

O-Z Improved Hand Tachometers



Do away with the troublesome sliding gear shift; ball-bearing, dust-proof, fool-proof, large dial, greatly reduced over all length. Five ranges on one spindle, for speeds from 20-40,000 R.P.M. Dead-beat, accurate within ½ of 1%. The only real improvement in tachometer construction in the last 20 years. *Write for new catalog.*

O. Zernickow Co., 21 Park Row, New York

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REFRIGERATING AND ICE MAKING MACHINERY—WATER TUBE & HORIZONTAL RETURN TUBULAR BOILERS DROP FORGED STEEL VALVES & FITTINGS—OIL REFINERY EQUIPMENT—*Ask for Bulletins*

HENRY VOGT MACHINE CO., Manufacturers, Louisville, Ky.

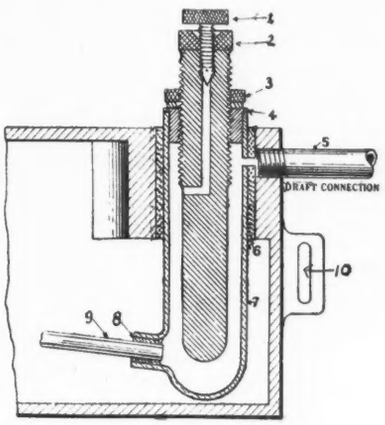
Hercules Seamless Copper Floats Last Indefinitely

Don't buy floats that wear out in a short time and have to be replaced. Hercules Floats because of their remarkable endurance, eliminate constant renewal and repair expense.

Write for prices and details

HERCULES FLOAT WORKS
200 Franklin St., Springfield, Mass.

Defender Patented DRAFT GAUGES



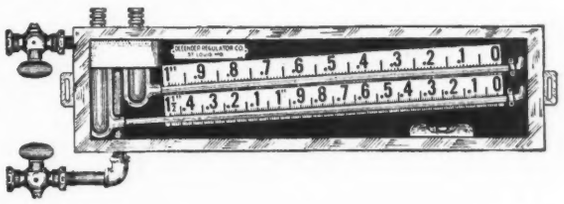
The above sectional view shows the latest improved type all metal Nickel Plated, Oil Chamber now used on all Defender Draft Gauges, as same is cemented into the Cast Aluminum case or frame of the Gauge.

It is equipped with a PATENTED combination Hollow Oil Filling and Oil Leveling displacement plunger, for screwing down into the oil so as to level the oil to the 0 or zero mark on the scale if any evaporates out of the incline tube.

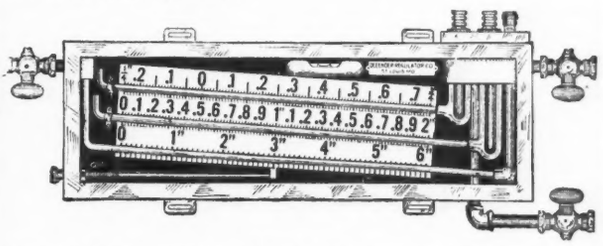
We claim this important improvement removed the last objection there was to the Incline Tube Oil Filled Draft Gauge and is one of the most important improvements since AMES Draft Gauge appeared, about a quarter of a century ago.

Above is shown the latest improved type of Defender 1-in. large size single tube Draft Gauge in the right hand and same is also supplied in the left hand Gauge.

It is equipped with the new large size all white Scale reading in hundredths and tenths of an inch of water vacuum. The Gauge is also supplied with any Scales from half-inch to 3-in. or in compound scales.



The above illustration shows the latest improved type Defender Duplex Draft Gauge, in the left hand type and same is also supplied in the right hand type. The top scale is 1-in. for reading Furnace Draft, the bottom scale is 1½ in. for reading Draft at last pass of the boiler below the damper. Any combination of scales can be supplied up to 3-in.



Defender 3-tube combination Draft and pressure Gauge for forced Draft Stokers or Furnaces, made in both right and left hand Gauges with any combination of scales.

A Draft Gauge for every purpose is shown in our new 24-page Bulletin No. 27, write for same.

DEFENDER AUTOMATIC REGULATOR CO.
308 S. 8th St., ST. LOUIS, MO.

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AND CENTRAL STATIONS FROM CALIFORNIA *to* FLORIDA

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FLORIDA

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City of Tallahassee, Tallahassee
Florida Public Service Corporation
Benson Springs & Avon Park
Florida Power Corporation
Port Ingles
City of Jacksonville, Jacksonville
Florida Power & Light Company
Fort Lauderdale
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MISCELLANEOUS

Federal Light & Traction Co.,
Hot Springs National Park, Ark.
Hartford Electric Light Co.,
Hartford, Conn.
Savannah Electric Company, Savannah, Ga.
Kansas Power & Light Co.,
Tecumseh, Kansas
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New Orleans Public Service, Inc.,
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Consumers Power Co., Detroit, Mich.
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100%

PEABODY Burners have been selected for ***all*** the Central Stations in California and Florida for the last three and one-half years.

The reasons, four!

1. Uninterrupted operation
2. Maximum efficiency
3. Minimum maintenance cost
4. Positive control

Peabody Burners are designed to burn all fuels and to meet all combustion conditions. Consult us about your combustion problems.

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ENGINEERING CORPORATION

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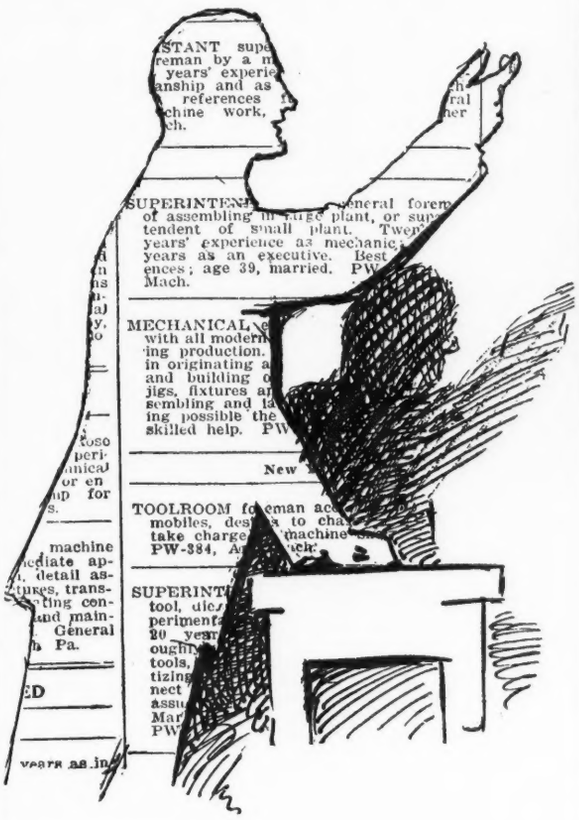
PHILADELPHIA PITTSBURGH NEW ORLEANS



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They go direct to those in the industry you wish to reach and tell your story in a forceful and business-like way.

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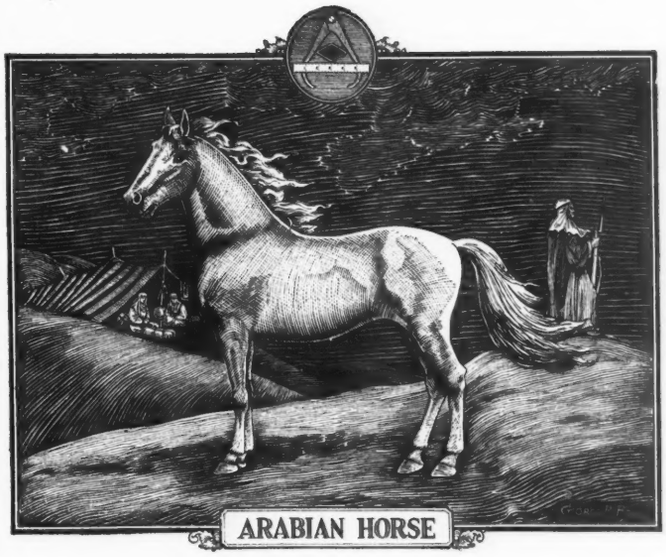
For Every Business Want "Think* SEARCHLIGHT *First"

GN-033



QUALITY

A characteristic of the Arabian Horse and also of the products manufactured by The Garlock Packing Co., Palmyra, N.Y.

ARABIAN horses were originally obtained from the Libyan tribes of Northern Africa. By long and careful mating the superior type has been maintained through many centuries. The breeding and raising of the Arabian horse is closely supervised and controlled by the owners so as to obtain certain desirable qualities such as endurance, strength, intelligence, tractability and fine appearance.

Realizing that quality in commodities, as well as in domestic animals, is secured by years of close supervision of details, The Garlock Packing Company has continually striven in the past quarter of a century to build products whose body structures and treatments are basically right to meet the requirements of an economical and satisfactory packing service.

This fundamental characteristic of Garlock manufacturing processes has merited the descriptive name *Quality Controlled Packings* for their products.

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An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

Power

POSITIONS VACANT

STEAM turbine engineer, old established company, manufacturing medium size single and multi stage turbines, has a good opening for a man with several years' experience in turbine work. He should have a thorough knowledge of thermodynamics for water rate calculations. Location in Eastern city under good working conditions. Apply by letter, giving full personal record, age and salary expected. All replies will be held in strict confidence. P-864, Power, Tenth Ave. at 36th St., New York, N. Y.

North Carolina

EXPERIENCED draftsman wanted, must be expert on machine design, and possess good engineering education for position in Southern Rayon plant just starting operation. P-860, Power, Tenth Ave. at 36th St., New York, N. Y.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000 and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established twenty years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 270 Main Street, Buffalo, New York.

$3,000.00-$30,000.00 men find our service effective in making connections. Individual. Confidential. Refund agreement. Not agency. Jacob Penn, Incorporated, 9 Park Place, New York.

POSITIONS WANTED

New Jersey

STATIONARY and combustion engineer, expert on any kind of fuel, boiler efficiency, economy and maintenance. PW-855, Power, Tenth Ave. at 36th Street, New York.

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For Immediate Sale and Removal

(Inspection invited at our Plant—New Hamburgh, N. Y.)

MOTORS—All 550 volt, 3 phase, 60 cycle, Alternating Current, of Allis Chalmers, Westinghouse, General Electric and Wagner Electric make.

Quantity	H.P.	Speed
2	125	600-585
5	200	585
1	75	(*1160)-580-625-585
3	150	585
1	25	(*860)
1	50	870
1	*20	1150

All are of Slip Ring Type except items asterisked.

SWITCHBOARD—1—Westinghouse, consisting of:—
1—Main Breaker, 3 pole, 2,000 amp. with overload attachment.
14—Circuits with ranges from 150 to 400 amp. each circuit provided with Westinghouse Air Circuit Breaker and Ammeter, all mounted on Slate Panels with necessary connecting busses.

TRANSFORMERS—3—Moloney 667 kva., 13,200-550-v. with high voltage taps.

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NEW YORK TRAP ROCK CORP.

Phone Eldorado 0500 — **250 Park Ave., New York City**

A.C. Turbo Units

1875 KVA. Wghse.—(Bleeder)
1250 KVA. G. E.—(Bleeder)
750 KVA. G. E.—(Bleeder)
625 KVA. Wghse.—15 lb. Back Pres.
250 KVA. G. E.—Up to 40 lb. Back Pres
125 KVA. G. E.—(Non-Condensing)
75 KVA. Wghse—(Non-Condensing)

A.C. Units

600 KVA. G. E.—Hamilton Tandem
600 KVA. G. E.—Filer Stowell Corliss
450 KVA. G. E.—Chuse Uniflow
400 KVA. G. E.—Nordberg Uniflow
375 KVA. G. E.—Chuse 4-Valve
250 KVA. G. E.—Nordberg Uniflow
150 KVA. G. E.—15x16 Skinner Uniflow
150 KVA. C. W.—Harrisburg Uniflow
100 KVA. C. W.—Erie-Ball 4-Valve

Direct Current Units

300 KW. G. E.—250 v., Hamilton Corliss
250 KW. G. E.—125 v., Erie-Ball 4-Valve
200 KW. G. E.—250 v., Erie-Ball 4-Valve
150 KW. G. E.—250 v., Erie-Ball 4-Valve
150 KW. C. W.—250 v., Skinner Uniflow

POWER PLANT EQUIPMENT CO., Inc. **39-41 Cortlandt St., New York City, N. Y.**

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For "Opportunities" of every kind: "Think SEARCHLIGHT First!"

G-43

TURBO GENERATORS

1—10,000 kva., Westgh. with LeBlanc condenser.
1—3750 kva., G. E., with surface condenser.
1—1500 kva., G. E., extraction type, condenser.
1—1000 kva., G. E., with Alberger condenser.
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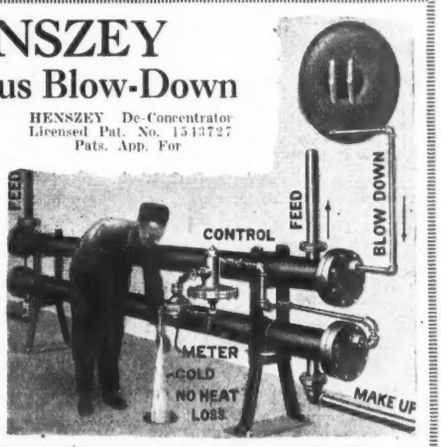

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0134

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Equipment, Apparatus and Supplies Used in the Power Plant Field with Names and Addresses of Manufacturers and Distributors Whose Advertisements Appear in This Issue

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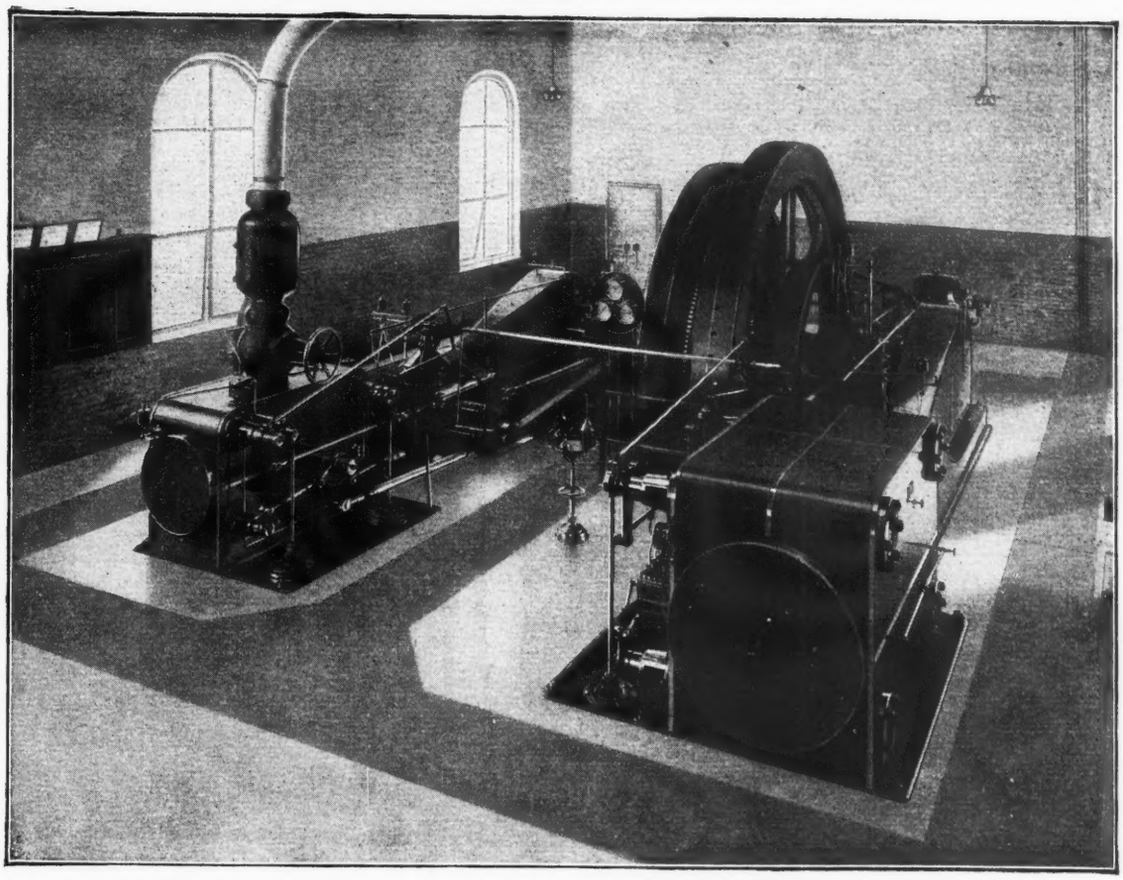
Terry Steam Turbine Co., Hartford
Covering, Pipe and Boiler
Carey Co., Philip, Cininnati
General Insulating & Mfg. Co., Alexandria
Lavino & Co., E. J., Philadelphia
Cranes
Shepard Crane Div. Shepard-Niles Crane & Hoist Corp., Montour Falls
Niles Cranes Div. Shepard-Niles Crane & Hoist Corp., Montour Falls
Cranes, Crawler Type, Locomotive Gas and Steam
Industrial Brownhoist Corp., Cleveland
Cutouts, Electric
General Electric Co., Schenectady
Cutters, Boiler Tube (See Pipe Cutters)
Dampers
Clarage Fan Co., Kalamazoo
Deaerators
Cochrane Corp., Phila.
Elliott Co., Jeannette
Dealers Machinery (See Searchlight Section)
Archer & Baldwin, Inc.
Consolidated Products Co., Inc.
Delta Equipment Co.
Fuerst, Friedman Co., The
Land, L. J.
Mehan Co., Andrew J.
O'Brien Mchy. Co.
Phoenix Utility Co.
Power Plant Equipment Co.
Randle Mchy. Co.
Sachsenmaier, Geo.
Desuperheaters
Elliott Co., Jeannette



Corliss Engines

are noted for their high efficiency, reliability and long life

Allis-Chalmers has built over 6,000,000 horsepower of Corliss engines during the past fifty years. During this period other types of steam prime movers have been developed but the Corliss engine still holds its place in industry, due to its efficiency and reliability.

Many Allis Corliss engines that were installed forty or more years ago are still in continuous operation.

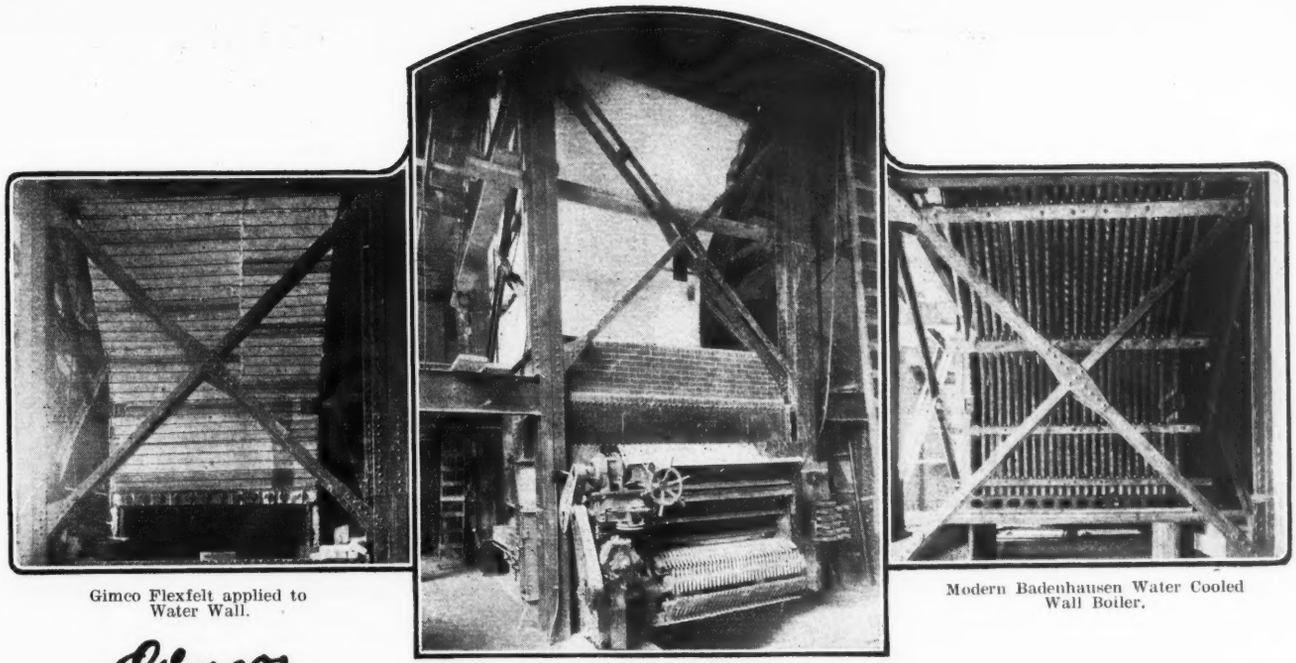
PRODUCTS

Electrical Machinery
Gas Engines
Steam Engines
Steam Turbines
Condensers
Oil Engines
Hydraulic Turbines
Pumping Engines
Centrifugal Pumps
Mining Machinery
Metallurgical Machinery
Crushing Machinery
Cement Machinery
Flour Mill Machinery
Saw Mill Machinery
Air Compressors
Tractors
Texrope Drives
Steam and Electric Hoists

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

Schutte Koerting, Philadelphia
Die Stocks
Curtis & Curtis Co., Bridgeport
Toledo Pipe Threading Machine Co., Toledo
Distilling Apparatus (Water)
Griscom-Russell Co., N. Y.
Doors, Furnace Inspection
Springfield (Ill.) Boiler Co.
Draft, Mechanical
(See Blowers, Fan)
Drainers, Low Pressure
Cochrane Corp., Phila.
Dressing, Belt
Texas Co., N. Y.
Drills
Jeffrey Mfg. Co., Columbus
Drop Forgings
Vogt Machine Co., Henry, Louisville
Dryers, Rotary & Vertical Waste Heat
Fuller Lehigh Co., Fullerton
Dust Collectors
Sturtevant Co., B. F., Hyde Park
Dust Removers
Sturtevant Co., B. F., Hyde Park
Dynamometers
Wheeler Mfg. Co., C. H., Phila.
Dynamos (See Generators)
Economizers
Alberger Heater Co., Buffalo
Foster Wheeler Corp., N. Y.
Green Fuel Economizer Co., Beacon.
Sturtevant Co., B. F., Hyde Park
Ejectors, Air
Elliott Company, Jeannette, Pa.
Wheeler Mfg. Co., C. H., Phila.
Ejectors, Sewage
Nash Engineering Co., South Norwalk
Ejectors, Water
Chaplin-Fulton Mfg. Co., Pittsburgh
Elliott Co., Jeannette, Pa.
Electric Generating Sets, Steam Turbine
Allis-Chalmers Mfg. Co., Milwaukee
Elliott Co., Jeannette
Moore Steam Turbine Corp., Wellsville, N. Y.
Sturtevant Co., B. F., Hyde Park
Terry Steam Turbine Co., Hartford
Elevators and Conveyors
Beaumont Co., R. H., Phila.
Industrial Brownhoist Corp., Cleveland
Jeffery Mfg. Co., Columbus
Engine Repairs
Fitchburg (Mass.) Steam Engine Co.
Engines, Corliss
Allis-Chalmers Mfg. Co., Milwaukee
Elliott Co., Jeannette
Engines, Diesel
Fulton Iron Works, St. Louis
McIntosh & Seymour Corp., Auburn
Engines, Gas and Oil
Allis-Chalmers Mfg. Co., Milwaukee
Fulton Iron Works, St. Louis
Ingersoll-Rand Co., N. Y.
Engines, Poppet Valve
Elliott Co., Jeannette
Engines, Steam
Air-Preheater Co., N. Y.
Allis-Chalmers Mfg. Co., Milwaukee
Clarage Fan Co., Kalamazoo
Fitchburg (Mass.) Steam Engine Co.
Fulton Iron Works, St. Louis
Skinner Engine Co., Erie
Sturtevant Co., B. F., Hyde Park
Engines, Una-Flow
Elliott Co., Jeannette
Fitchburg (Mass.) Steam Engine Co.
Kingsford Fdy. & Mach. Co., Oswego
Skinner Engine Co., Erie
Evaporators
Foster Wheeler Corp., N. Y.
Griscom-Russell Co., N. Y.
Exhaust Heads
Burt Mfg. Co., Akron
Sturtevant Co., B. F., Hyde Park
Swartwout Co., Cleveland
Exhausters, Gas
Sturtevant Co., B. F., Hyde Park
Expansion Joints
Carey Co., Philip, Cincinnati
Foster Wheeler Corp., N. Y.
Griscom-Russell Co., N. Y.
Howard Iron Works, Buffalo
Ross Heater & Mfg. Co., Buffalo
Wheeler Mfg. Co., C. H., Phila.
Yarnell-Waring Co., Philadelphia
Extractors, Oil Grease
Elliott Co., Jeannette
Fans, Exhaust and Ventilator
(See Blowers, Fan)
Fans, Forced and Induced Draft
Green Fuel Economizer Co., Beacon
Coppus Engineering Corp., Worcester
Sturtevant Co., B. F., Hyde Park
Feeders, Pulverized Coal
Fuller-Lehigh Co., Fullerton
Filters, Feed Water, Pressure, Water
Cochrane Corp., Phila.
Elliott Co., Jeannette
Griscom-Russell Co., N. Y.
Filters, Oil
Burt Mfg. Co., Akron
Elliott Co., Jeannette
Filters, Oil Removal
Elliott Co., Jeannette
Griscom-Russell Co., N. Y.
Filters, Oil System
Burt Mfg. Co., Akron
Firebox, Blocks
Bernitz Furnace Appliance Co., Boston
Fire Hydrants
Howard Iron Works, Buffalo
Fittings, Ammonia
Greene Tweed & Co., N. Y.
Vogt Machine Co., Henry, Louisville
Fittings, Steel
Limbert & Co., Geo. B., Chicago
Pittsburgh (Pa.) Piping & Equip. Co.
Flanges
Dart Mfg. Co., E. M., Providence
Jefferson Union Co., N. Y.
Jenkins Bros., N. Y.
Limbert & Co., Geo. B., Chicago
Pittsburgh (Pa.) Piping & Equip. Co.
Pittsburgh (Pa.) Valve Foundry & Construction Co.
Power Piping Co., Pittsburgh
Vogt Machine Co., Henry, Louisville
Floats
Hercules Float Works, Springfield
Floor Armoring
Blaw-Knox Co., Pittsburgh
Flooring, Fireproof
Blaw-Knox Co., Pittsburgh
Dravo Doyle Co., Pittsburgh
Tri-Lok Co., Pittsburgh
Flooring, Non-Slipping
Blaw-Knox Co., Pittsburgh
Dravo Doyle Co., Pittsburgh
Tri-Lok Co., Pittsburgh
Flooring, Open Steel
Blaw-Knox Co., Pittsburgh
Dravo Doyle Co., Pittsburgh
Tri-Lok Co., Pittsburgh
Flooring, Steel
Blaw-Knox Co., Pittsburgh
Dravo Doyle Co., Pittsburgh
Tri-Lok Co., Pittsburgh
Flooring, Ventilating
Blaw-Knox Co., Pittsburgh
Dravo Doyle Co., Pittsburgh
Tri-Lok Co., Pittsburgh
Floors, Water Cooled
Badenhausen Corp., Cornwells Heights
Fuel Oil Systems
Coen Co., San Francisco
Combustion Engineering Corp., N. Y.
Hammel Oil Burning Equipment Co., Providence
International Combustion Engineering Corp., N. Y.
Peabody Engineering Corp., N. Y.
Furnace Arches
Bigelow-Liptak Corp., Detroit
Lavino & Co., E. J., Philadelphia
Furnace Bottoms
Beaumont Co., R. H., Phila.
Furnace Bottoms, Cast Iron Air Cooled
Allen, Sherman, Hoff Co., Phila.
Furnace Construction
Bernitz Furnace Appliance Co., Boston
Bigelow-Liptak Corp., Detroit
General Refractories Co., Phila.
Laclede-Christy, St. Louis
Lavino & Co., E. J., Philadelphia
Furnace Linings
American Engineering Co., Phila.
Babcock & Wilcox Co., N. Y.
Bernitz Furnace Appliance Co., Boston
Bigelow Liptak Corp., Detroit
Green Fire Brick Co., A. P., Mexico
General Refractories Co., Phila.
Harbison-Walker Refractories Co., Pittsburgh
Laclede Christy, St. Louis
Lavino & Co., E. J., Philadelphia
Furnace Walls, Water Cooled
American Engineering Co., Phila
Bernitz Furnace Appliance Co., Boston
Blaw-Knox Co., Pittsburgh
Combustion Engineering Corp., N. Y.
Foster Wheeler Corp., N. Y.
FullerLehigh Co., Fullerton
International Combustion Eng. Corp., N. Y.
Furnaces
American Engineering Co., Phila.
Combustion Engineering Corp., N. Y.
Detroit Stoker Co., Detroit
Fuller Lehigh Co., Fullerton, Pa.
International Combustion Engineering Corp., N. Y.
McClave Brooks Co., Scranton
Furnaces, Bagasse & Wood Burning
Bigelow-Liptak Corp., Detroit
Combustion Engineering Corp., N. Y.
International Combustion Engineering Corp., N. Y.
McClave-Brooks Co., Scranton
Furnaces, Incinerator
Combustion Engineering Corp., N. Y.
International Combustion Engineering Corp., N. Y.
McClave-Brooks Co., Scranton
Fuses
General Electric Co., Schenectady
Gage Glass Guards & Shields
Chesterton Co., A. W., Boston
Jenkins Bros., N. Y.
Gage Glasses
Chesterton Co., A. W., Boston
Jenkins Bros., N. Y.
Gages, Boiler, Water Level, Distant Reading
Brown Instrument Co., Philadelphia
Gages, Differential, Draft, Indicating Liquid Depth, Pressure, Recording, Vacuum, Water
Ashton Valve Co., Cambridge, Mass.
Bailey Meter Co., Cleveland
Bristol Co., Waterbury, Conn.
Defender Automatic Regulator Co., St. Louis
Greene, Tweed & Co., N. Y.
Jenkins Bros., N. Y,
Hays Corp., Michigan City
Republic Flow Meters Co., Chicago
Yarnall-Waring Co., Phila.
Gas Burning Equipment
Coen Co., San Francisco
Peabody Engineering Corp., N. Y.
Gas Collectors
Hays Corp., Michigan City
Gas Exhausters
General Electric Co., Schenectady
Gaskets
Advance Packing Co., Chicago
Flexitalic Gasket Co., Camden
Garlock Packing Co., Palmyra
Greene, Tweed & Co., N. Y.
Jenkins Bros., N. Y.
Metallo Gasket Co., New Brunswick
Smooth-On Mfg. Co., Jersey City
Gates, Air Blast
McClave Brooks Co., Scranton
Gates, Coal & Ash Bin
Allen, Sherman, Hoff Co., Phila.
Beaumont Co., R. H., Phila.
Hunt Co., C. W., West New Brighton, N. Y.
Industrial Brownhoist Corp., Cleveland
Jeffrey Mfg. Co., Columbus
Gears
Jeffrey Mfg. Co., Columbus
Philadelphia Gear Works, Phila.
Gears, Double Helical
De Laval Steam Turbine Co., Trenton
Gears, Reduction
De Laval Steam Turbine Co., Trenton
Elliott Co., Jeannette
Moore Steam Turbine Corp., Wellsville
Philadelphia Gear Works, Phila.
Sturtevant Co., B. F., Hyde Park
Terry Steam Turbine Co., Hartford
Generating Sets
General Electric Co., Schenectady
Generators, Electric
Elliott Co., Jeannette
General Electric Co., Schenectady
Sturtevant Co., B. F., Hyde Park
Generators, Engine
Elliott Co., Jeannette
Governors, Pump
Atlas Valve Co., Newark
Chaplin-Fulton Mfg. Co., Pittsburgh
Davis Regulator Co., G. M., Chicago
Northern Equipment Co., Erie
Squires Co., C. E., Cleveland
Swartwout Co., Cleveland
Graphite
Greene, Tweed & Co., N. Y.
Grates, Dumping
Babcock & Wilcox Co., N. Y.
Combustion Engineering Corp., N. Y.
CoKal Stoker Corp., Chicago
Cyclone Grate Bar Co., Buffalo
International Combustion Engineering Corp., N. Y.
McClave-Brooks Co., Scranton
Neemes Fdry., Inc., Troy, N. Y.
Vogt Mach. Co., Henry, Louisville
Grates, Shaking
Babcock & Wilcox Co., N. Y.
CoKal Stoker Corp., Chicago
Combustion Engineering Corp., N. Y.
Cyclone Grate Bar Co., Buffalo
International Combustion Engineering Corp., N. Y.
McClave-Brooks Co., Scranton
Neemes Fdry., Inc., Troy, N. Y.
Vogt Mach. Co., Henry, Louisville
Grates, Stationary
Babcock & Wilcox Co., N. Y.
Combustion Engineering Corp., N. Y.
International Combustion Engineering Corp., N. Y.
Vogt. Mach. Co., Henry, Louisville
Grating
Blaw-Knox Co., Pittsburgh
Dravo Doyle Co., Pittsburgh
Tri-Lok Co., Pittsburgh
Grease
Texas Co., N. Y.
Grease Extractors
Elliott Co., Jeannette
Headers, Welded
Limbert & Co., Geo. B., Chicago
Midwest Piping & Supply Co., St. Louis
Heat Exchangers
Foster Wheeler Corp., N. Y.
Ross Heater & Mfg. Co., Buffalo
Wheeler Mfg. Co., C. H., Philadelphia
Heaters, Air
Air-Preheater Co., N. Y.
Babcock & Wilcox Co., N. Y.
Badenhausen Corp., Cornwells Heights
Blaw-Knox Co., Pittsburgh
Combustion Engineering Corp., N. Y.
Foster Wheeler Corp., N. Y.
International Combustion Engineering Corp., N. Y.
Prat-Daniel Corp., N. Y.
Sturtevant Co., B. F., Hyde Park
Heaters, Bleeder
Foster Wheeler Corp., N. Y.
Heaters, Domestic
Alberger Heater Co., Buffalo
Ross Heater & Mfg. Co., Buffalo
Heaters, Deaerating
Cochrane Corp., Phila.
Elliott Co., Jeannette
Heaters, Feed Water
Cochrane Corp., Phila.
Elliott Co., Jeannette
Foster Wheeler Corp., N. Y.
Griscom-Russell Co., N. Y.
Ross Heater & Mfg. Co., Buffalo
Sturtevant Co., B. F., Hyde Park
Swartwout Co., Cleveland
Wheeler Mfg. Co., C. H., Phila.
Heaters, Hot Water Service
Foster Wheeler Corp., N. Y.
Heaters, Metering
Cochrane Corp., Phila.
Heaters, Oil
Alberger Heater Co., Buffalo
Coen Co., San Francisco
Foster Wheeler Corp., N. Y.
Griscom-Russell Co., N. Y.
Hammel Oil Burning Equipment Co., Providence
Wheeler Mfg. Co., C. H., Phila.
Heaters, Steam Stack
Cochrane Corp., Phila.
Heaters, Storage
Cochrane Corp., Phila.
Heaters, Unit
Buffalo Forge Co., Buffalo
Sturtevant Co., B. F., Hyde Park
Heating and Ventilating Systems
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo
Prat-Daniel Corp., N. Y.
Sturtevant Co., B. F., Hyde Park
Heating Specialties
Minneapolis Honeywell Regulator Co., Minneapolis
Hoists, Air
Ingersoll-Rand Co., N. Y.
Hoists, Skip
Beaumont Co., R. H., Phila.
Hoists, Steam
Sullivan Machinery Co., Chicago
Hoppers, Coal and Ash
Allen-Sherman-Hoff Co., Phila.
Beaumont Co., R. H., Phila.
Combustion Engineering Corp., N. Y.
International Combustion Engineering Corp., N. Y.
Jeffrey Mfg. Co., Columbus
Hose, Rubber, For Air, Steam, Tube Cleaners, Water
Lagonda Mfg. Co., Springfield, O.
Liberty Mfg. Co., Jeannette
Pioneer Rubber Mills, San Francisco
Hydrants
Michigan Valve & Fdry. Co., Detroit
Ice and Refrigerating Machinery (See Refrigerating Machinery)
Indicators, Speed
Zernickow Co., O., N. Y.
Injectors
Jenkins Bros., N. Y.
Schutte Koerting, Philadelphia
Insulation, Boiler
General Insulating & Mfg. Co., Alexandria
Insulation, Duct
General Insulating & Mfg. Co., Alexandria
Insulation, Heat
Carey Co., Philip, Cincinnati
Intercoolers
Foster Wheeler Corp., N. Y.
Griscom-Russell Co., N. Y.
Lubricants
Texas Co., N. Y.
Lubricators, Cylinder
Greene, Tweed & Co., N. Y.
Lunkenheimer Co., Cincinnati
Lubricators, Force Feed
Greene, Tweed & Co., N. Y.
Machine Work, Special
Howard Iron Works, Buffalo
Machinery Built to Order
Dodge Mfg. Corp., Mishawaka
Meters, Air, Boiler, Flow, Gas, Oils, Steam, Water
Bailey Meter Co., Cleveland
Cochrane Corp., Phila
Elliott Co., Jeannette
Simplex Valve & Meter Co., Philadelphia
Republic Flow Meters Co., Chicago
Yarnall-Waring Co., Phila.
Meters, Coal
Bailey Flow Meters Co., Chicago
Republic Flow Meters Co., Chicago
Meters, Electric
General Electric Co., Schenectady
Meters, V-Notch
Bailey Meter Co., Cleveland
Cochrane Corp., Phila.
Yarnall-Waring Co., Phila.
Meters, Volumetric
Cochrane Corp., Phila.
Yarnall-Waring Co., Phila.
Meters, Weighing
Cochrane Corp., Phila.
Motor, Generator
Elliott Co., Jeannette, Pa.
Motors, Electric
Allis-Chalmers Mfg. Co., Milwaukee
Electric Machinery Mfg. Co., Minneapolis
Elliott Co., Jeannette
General Electric Co., Schenectady
Sturtevant Co., B. F., Hyde Park, Mass.
Motors, Water
Roto Co., Newark, N. J.
Oil and Grease Cups
Lunkenheimer Co., Cincinnati
Powell Co., Wm., Cincinnati
Oil, Fuel
Texas Co., N. Y.
Oil, Lubricating
Dearborn Chemical Co., Chicago



Gimco Flexfelt applied to Water Wall.

Gimco K-14 and Hard X Insulating Cements, applied over Flexfelt showing finished coat.

Modern Badenhausen Water Cooled Wall Boiler.

Gimco ROCK WOOL

FLEXFELT

The Rock Wool Insulation for Boilers, Hot Air Ducts, Air Heaters and Steam Piping—

FLEXFELT, the Rock Wool Insulation, holds the heat inside of these three modern Badenhausen Boilers, Preheaters, hot air ducts, hot and cold water tanks, at the Franklin Heating Station, Rochester, Minnesota. The Franklin Heating Station is a central heating and power plant furnishing power and light, high and low pressure steam, refrigeration and compressed air, hot and cold water to the buildings of the Mayo Association and of the Kahler Corporation. This complete installation represents the latest and most up-to-date power plant equipment.

GIMCO FLEXFELT PIPE COVERING is made in seven different styles and is the most economical now on the market, both from the point of efficiency and the labor of applying—facts which are proved by numerous installations.

The U. S. Bureau of Standards tests show that Gimco Rock Wool has a heat conductivity of only .27 B.t.u. per sq. ft.

The application of GIMCO FLEXFELT PIPE COVERING results in a BIG SAVING IN LABOR, because the outside as the finishing coat, weather canvas, roofing, asbestos covering or metal jacket are ALL installed in ONE OPERATION.

Another big feature is the 100% SALVAGE VALUE. The covering can be removed from the pipes and used over and over again WITHOUT BREAKING UP.

GIMCO FLEXFELT PIPE COVERING is guaranteed to stand up under temperatures to 1250 deg. F., without deterioration.

Flexfelt is made any size, shape or thickness, rigid or flexible. Write for our new Flexfelt Catalogue No. 400, Brick and Cement Catalogue No. 300 and Gimco Cork Catalogue No. 401.

Gimco Flexfelt. No. 409

Gimco Pipe Covering, Style No. 205

Gimco Rock Wool is available in the following forms and shapes:

Flexfelt—standard shapes or cut to fit.

Gimco K-14 Insulating Cement.

Gimco Rock Wool Insulating Block & Brick.

Gimco Rock Wool Cork for Cold Storage Insulation.

GENERAL INSULATING & MFG. CO., Alexandria, Ind.

Eastern Representative: General Insulating Products Co., Brooklyn, N. Y.
California Representative: R. C. Carmien, Hollywood, California

Representatives:

C. W. Poe Co., Cleveland, Ohio
L. Mundet & Sons, Inc., St. Louis, Mo.
E. T. Kelley, Houston, Texas
Denver Fire Clay Co., Denver, Colo.
Seattle Asbestos Co., Seattle, Wash.
Walter L. Schaeffer, Chicago, Ill.
H. M. Gassman, Birmingham, Ala.
N. Merion, Detroit, Mich.
Jones Bros., San Francisco, Calif.

Texas Co., N. Y.

Oil Purifiers
Burt Mfg. Co., Akron

Oil Reservoirs
Burt Mfg. Co., Akron

Oiling Devices and Systems
Burt Mfg. Co., Akron
Elliott Co., Jeannette

Packing, Asbestos
Advance Packing Co., Chicago
Garlock Packing Co., Palmyra
Greene, Tweed & Co., N. Y.

Packing, Condenser Tube
Garlock Packing Co., Palmyra

Packing, Cylinder, Hydraulic, Piston, Rod, Sheet, Valve Stem, Pump Valve
Advance Packing Co., Chicago
Chesterton Co., A. W., Boston
Garlock Packing Co., Palmyra
Greene, Tweed & Co., N. Y.
Jenkins Bros., N. Y.
Pioneer Rubber Mills, San Francisco

Packing, Flax
Chesterton Co., A. W., Boston
Garlock Packing Co., Palmyra
Greene, Tweed & Co., N. Y.

Packing, Metallic
France Packing Co., Phila.

Packing, Plastic Metallic
Garlock Packing Co., Palmyra

Paints, Rust Preventing
Dearborn Chemical Co., Chicago

Pipe
Kellogg Co., M. W., N. Y.
Limbert & Co., Geo. B., Chicago
Midwest Pipe & Supply Co., St. Louis
Power Piping Co., Pittsburgh

Pipe Bending
Kellogg Co., M. W., N. Y.
Limbert & Co., Geo. B., Chicago
Midwest Piping & Supply Co., St. Louis
National Valve & Mfg. Co., Pittsburgh
Pittsburgh (Pa.) Piping & Equip. Co.
Pittsburgh (Pa.) Valve Foundry & Construction Co.
Power Piping Co., Pittsburgh
Standard Wire & Tube Co., Mineral Ridge

Pipe, Brass & Copper
Foster Wheeler Corp, N. Y.
Scovill Mfg. Co., Waterbury

Pipe, Chrome Alloy
Babcock & Wilcox Tube Co., Beaver Falls

Pipe Coils
Midwest Piping & Supply Co., St. Louis
Pittsburgh (Pa.) Valve Foundry & Construction Co.

Pipe Cutting & Threading Machines
Curtis & Curtis Co., Bridgeport
Toledo (Ohio) Pipe Threading Machine Co.

Pipe Fittings
Jefferson Union Co., N. Y.
Kellogg Co., M. W., N. Y.
Limbert & Co., Geo. B., Chicago
Power Piping Co., Pittsburgh

Pipe Hangers and Supports
Grinnell Co., Providence
Midwest Piping & Supply Co., St. Louis

Pipe, Seamless Steel
Babcock & Wilcox Tube Co., Beaver Falls

Pipe, Welded & Seamless
Kellogg Co., M. W., N. Y.

Piping Contractors
Baker Co., R. H., Cambridge
Kellogg Co., M. W., N. Y.
Limbert & Co., Geo. B., Chicago
Midwest Piping & Supply Co., St. Louis
National Valve & Mfg. Co., Pittsburgh
Pittsburgh (Pa.) Piping & Equip. Co.
Pittsburgh (Pa.) Valve Foundry & Construction Co.
Power Piping Co., Pittsburgh

Piping Fabricators
Kellogg Co., M. W., N. Y.
Limbert & Co., Geo. B., Chicago
Midwest Piping & Supply Co., St. Louis

Pipe Hangers and Supports
Limbert & Co., Geo. B., Chicago

Piping, High Pressure
Baker Co., R. H. Cambridge
Kellogg Co., M. W., N. Y.
Limbert & Co., Geo. B., Chicago
Midwest Piping & Supply Co., St. Louis
National Valve & Mfg. Co., Pittsburgh
Pittsburgh (Pa.) Piping & Equip. Co.
Pittsburgh (Pa.) Valve Foundry & Construction Co.
Power Piping Co., Pittsburgh
Standard Wire & Tube Co., Mineral Ridge

Pneumatic Tools
Ingersoll-Rand Co., N. Y.

Power Transmission Machinery
Allis-Chalmers Mfg. Co., Milwaukee
Dodge Mfg. Corp., Mishawaka
Jeffrey Mfg. Co., Columbus

Pre-Heaters, Air
Air-Preheater Co., N. Y.
Blaw-Knox Co., Pittsburgh
Buffalo Forge Co., Buffalo
Edge Moor (Del.) Iron Co.

Pulleys
Caldwell Co., W. E., Louisville
Greene, Tweed & Co., N. Y.

Pulverized Coal Equipment
Bigelow-Liptak Corp., Detroit
Combustion Engineering Corp., N. Y.
Foster Wheeler Corp., New York
Fuller Lehigh Co., Fullerton
International Combustion Engineering Corp., N. Y.
Jeffrey Mfg. Co., Columbus
Peabody Engineering Corp., N. Y.
Strong-Scott Mfg. Co., Minneapolis

Pumps, Air
Elliott Co., Jeannette, Pa.
Foster Wheeler Corp., New York
Wheeler Mfg. Co., C. H., Phila.

Pumps, Airlift
Ingersoll-Rand Co., N. Y.
Pennsylvania Pump Compressor Co., Easton

Pumps, Boiler Feed
Cameron Steam Pump Wks., A. S., N. Y. (Ingersoll-Rand Co.)
Goulds Pumps, Inc., Seneca Falls
Ingersoll-Rand Co., N. Y. (A. S. Cameron Steam Pump Wks.)

Pumps, Centrifugal
Allis Chalmers Mfg. Co., Milwaukee
Buffalo Steam Pump Co., Buffalo
Cameron Steam Pump Wks., A. S., N. Y. (Ingersoll-Rand Co.)
De Laval Steam Turbine Co., Trenton
Elliott Co., Jeannette
Foster Wheeler Corp., N. Y.
Frederick (Md.) Iron & Steel Co.
Goulds Pumps, Inc., Seneca Falls
Ingersoll-Rand Co., N. Y., (A. S. Cameron Steam Pump Wks.)
Kingsford Fdry. & Mch. Wks., Oswego
Lecourtenay Co., Newark
Manistee (Mich.) Iron Wks. Co.
John H. McGowan Co., Cincinnati
Moore Steam Turbine Corp., Wellsville
Nash Engineering Co., South Norwalk
Pennsylvania Pump & Compressor Co., Easton
Terry Steam Turbine Co., Hartford
Wheeler Mfg. Co., C. H., Phila.

Pumps, Condensate
Cameron Steam Pump Wks., A. S., N. Y. (Ingersoll-Rand Co.)
Elliott Co., Jeannette
Goulds Pumps, Inc., Seneca Falls
Ingersoll-Rand Co., N. Y. (A. S. Cameron Steam Pump Wks.)
Wheeler Mfg. Co., C. H., Phila.

Pumps, Force Feed (See Lubricators)

Pumps, Gear
Schutte Koerting, Philadelphia

Pumps, Mine
Allis-Chalmers Mfg. Co., Milwaukee
Pennsylvania Pump & Compressor Co., Easton

Pumps, Oil
Hammel Oil Burning Equipment Co., Providence
Lunkenheimer Co., Cincinnati

Pumps, Power
Goulds Pumps, Inc., Seneca Falls
Platt Iron Wks., Dayton

Pumps, Pulverized Coal
Fuller Lehigh Co., Fullerton

Pumps, Reciprocating
Allis-Chalmers Mfg. Co., Milwaukee
Buffalo (N. Y.) Steam Pump Co.
Cameron Steam Pump Wks., A. S., N. Y. (Ingersoll-Rand Co.)
Goulds Pumps, Inc., Seneca Falls
Ingersoll-Rand Co., N. Y., (A. S. Cameron Steam Pump Wks.)
Manistee (Mich.) Iron Wks. Co.
John H. McGowan Co., Cincinnati
Platt Iron Wks., Dayton

Pumps, Rotary
Goulds Pumps, Inc., Seneca Falls
Wheeler Mfg. Co., C. H., Phila.

Pumps, Sump
Cameron Steam Pump Wks., A. S., N. Y. (Ingersoll-Rand Co.)
Goulds Pumps, Inc., Seneca Falls
Ingersoll-Rand Co., N. Y. (A. S. Cameron Steam Pump Wks.)

Pumps, Underwriters, Centrifugal
Economy Pumping Machinery Co., Chicago

Pumps, Vacuum
Combustion Engineering Corp., N. Y.
Elliott Co., Jeannette
Foster Wheeler Corp., New York
Green Fuel Economizer Co., Beacon
International Combustion Engineering Corp., N. Y.
Ingersoll-Rand Co., N. Y., (A. S. Cameron Steam Pump Wks.)
Pennsylvania Pump & Compressor Co., Easton
Prat-Daniel Corp., N. Y.
Sturtevant Co., B. F., Hyde Park
Sullivan Machinery Co., Chicago
Wheeler Mfg. Co., C. H., Phila.

Purifiers, Feed Water
Cochrane Corp., Phila.
Griscom-Russell Co., N. Y.

Purifiers, Steam
Blaw-Knox Co., Pittsburgh
Cochrane Corp., Phila.
Hagan Corp., Pittsburgh
Marley Co., Kansas City

Pyrometers
Bristol Co., Waterbury
Defender Automatic Regulator Co., St. Louis
Republic Flow Meters Co., Chicago

Recorders, Draft
Bailey Meter Co., Cleveland
Hays Corp., Michigan City

Recorders, Flow, Liquid Level Pressure, Speed, Temperature
Bailey Meter Co., Cleveland
Republic Flow Meters Co., Chicago

Refractory Shapes, Special
Babcock & Wilcox Co., N. Y.

Refractories
General Refractories Co., Phila.
King Refractories Co., Buffalo
Lavino & Co., E. L., Philadelphia

Refrigerating Machinery
Ingersoll-Rand Co., N. Y.
Vogt Machine Co., Henry, Louisville

Regulators, Blower
McClave-Brooks Co., Scranton

Regulators, Damper, Draft and Fan
Atlas Valve Co., Newark
Defender Automatic Regulator Co., St. Louis
Hagan Corp., Pittsburgh
Powers Regulator Co., Chicago
Smoot Engr. Corp., N. Y.

Regulators, Feed Water
Atlas Valve Co., Newark
Bailey Meter Co., Cleveland
Chaplin-Fulton Mfg. Co., Pittsburgh
Defender Automatic Regulator Co., St. Louis
Northern Equipment Co., Erie
Squires Co., C. E., Cleveland
Swartwout Co., Cleveland

Regulators, Gas
Davis Regulator Co., G. M., Chicago

Regulators, Pressure
Bailey Meter Co., Cleveland
Chaplin-Fulton Mfg. Co., Pittsburgh
Davis Regulator Co., G. M., Chicago
T'Este Co., Julian, Boston
Minneapolis Honeywell Regulator Co., Minneapolis
Powers Regulator Co., Chicago
Squires Co., C. E., Cleveland

Regulators, Pump
Squires Co., C. E., Cleveland

Regulators, Temperature
Bristol Co., Waterbury, Conn.
T'Este Co., Julian, Boston
Minneapolis Honeywell Regulator Co., Minneapolis
Powers Regulator Co., Chicago
Sarco Co., Inc., N. Y.

Rheostats
General Electric Co., Schenectady

Rope Transmission
Hunt Co., C. W., W. New Brighton, N. Y.

Rubber Goods
Pioneer Rubber Mills, San Francisco

Rust Preventives
Dearborn Chemical Co., Chicago
Standard Engineering & Lubricating Co., N. Y.

Safety Steps, Steel
Blaw-Knox Co., Pittsburgh

Scale Removers, Boiler Tube
General Specialty Co., Buffalo
Lagonda Mfg. Co., Springfield
Liberty Mfg. Co., Jeannette
Roto Co., Newark, N. J.

Scrapers, Cable Drag
Beaumont Co., R. H., Phila.

Scrapers, Drag-Coal
Beaumont Co., R. H., Phila.

Second-Hand Equipment (See Searchlight Section)
Archer & Baldwin, Inc.
Consolidated Products Co., Inc.
Delta Equipment Co.
Fuerst, Friedman Co., The
Land, L. J.
Meban Co., Andrew J.
O'Brien Machy. Co.
Phoenix Utility Co.
Power Plant Equipment Co.
Randle Mchy. Co.
Sachsenmaier, Geo.

Separators, Air, Ammonia, Oil Steam
Cochrane Corp., Phila.
Elliott Co., Jeannette
Griscom-Russell Co., N. Y.
Hagan Corp., Pittsburgh
Marley Co., Kansas City
Nicholson & Co., W. H., Wilkes-Barre
Swartwout Co., Cleveland

Separators, Receiver
Cochrane Corp., Phila.
Yarnall-Waring Co., Phila.

Skip Hoists, Ash
Beaumont Co., R. H., Phila.

Speed Reducers
De Laval Steam Turbine, Trenton
Philadelphia Gear Works, Phila.

Spray Nozzles (See Cooling Plants and Ponds)

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Custodis Chimney Constr. Co., Alphons, New York
Kellogg Co., M. W., N. Y.
Rust Engineering Co., Pittsburgh

Stacks, Concrete
Custodis Chimney Construction Co., Alphons, New York
Kellogg Co., M. W., N. Y.

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Connery & Co., Phila.
Heine Boiler Co., N. Y.
Prat-Daniel Corp., N. Y.
Union Iron Works, Erie,

Steel Plate Work
Union Iron Works, Erie

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Babcock & Wilcox Co., N. Y.
Combustion Engineering Corp., N. Y.
Illinois Stoker Co., Alton
International Combustion Engineering Corp., N. Y.
Johnston & Jennings Co., Cleveland
Laclede Stoker Co., St. Louis
McClave Brooks Co., Scranton

Stokers, Hand Operated
CoKal Stoker Corp., Chicago
Combustion Engineering Corp., N. Y.
Flynn & Emrich Co., Baltimore
International Combustion Engineering Corp., N. Y.
McClave-Brooks Co., Scranton

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American Engineering Co., Phila.
Babcock & Wilcox Co., N. Y.
CoKal Stoker Corp., Chicago
Combustion Engineering Corp., N. Y.
Detroit Stoker Co., Detroit
Flynn & Emrich Co., Baltimore
Illinois Stoker Co., Alton
International Combustion Engineering Corp., N. Y.
Johnston & Jennings Co., Cleveland
Laclede Stoker Co., St. Louis
McClave-Brooks Co., Scranton

Stops, Engine
Gas Combustion Co., Pittsburgh

Strainers, Oil, Steam, Water
Coen Co., San Francisco
Elliott Co., Jeannette
Griscom-Russell Co., N. Y.
Sarco Co., Inc., N. Y.

Strainers, Pump Suction
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Marley Co., Kansas City

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Zernickow Co., O., N. Y.

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Connery & Co., Phila.
Heine Boiler Co., N. Y.
Union Iron Works, Erie, Pa.

Tanks, Ash Storage
United Conveyors Corp., Chicago

Tanks, Copper
Hercules Float Wks., Springfield

Thermometers, Controlling, Indicating, Recording
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Bristol Co., Waterbury
Defender Automatic Regulator Co., St. Louis

Thermometers, Flue, Gas
Bailey Meter Co., Cleveland

Transformers
Allis-Chalmers Co., Milwaukee
General Electric Co., Schenectady

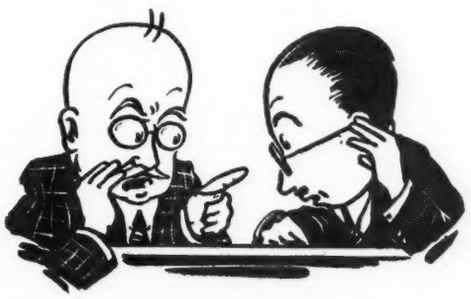
Traps, Air, Grease, Non-Return, Return, Radiator, Steam, Vacuum
Armstrong Machine Wks., Three Rivers
Cochrane Corp., Phila.
Davis Regulator Co., G. M., Chicago
T'Este Co., Julian, Boston
Elliott Co., Jeannette
Ellis Drier Co., Chicago
Hobson, Russell B., Great Notch
Holbrook & Sons, A. W., Palmer
Jenkins Bros., N. Y.
Morehead Mfg. Co., Detroit
Nason Mfg. Co., N. Y.
Nicholson & Co., W. H., Wilkes-Barre
Powers Regulator Co., Chicago
Sarco Co., N. Y.
Squires Co., C. E., Cleveland
Sterling Engr. & Mfg. Corp., Boston
Swartwout Co., Cleveland

Tube Bending
Standard Wire & Tube Co., Mineral Ridge

Tube Cleaners, Boiler
Chesterton Co., A. W., Boston
General Specialty Co., Buffalo

This is one of a series of advertisements directed originally to advertising men in an effort to make industrial advertising more profitable to buyer and seller. It is printed in these pages as an indication to readers that McGraw-Hill publishing standards mean advertising effectiveness as well as editorial virility.

Squelching another whispering campaign—



"Look out for that company, it's slipping," said the whisperers. Its product, an assembled unit sold to manufacturers to build into their machines, was of high quality but had been sold only through salesmen and direct mail.

Sales *were* falling off. The market, conscious of the gossip, was suspicious of the financial strength of the seller. This increasing sales resistance was undermining the morale of the sales staff.

With this serious situation facing it, the company called in an advertising agent who recommended an emergency advertising campaign in a McGraw-Hill publication covering the particular market. The program, the first publication advertising ever used by this company, consisted of color spreads in every issue.

That was only a year ago. Today, as evidence of the company's comeback, sales are not only mounting but the advertiser's chief competitor has offered to sell out to the new advertiser. *From bottom place to top position in recognition in one year.*

MORAL: Selling is not a choice between salesmen, publication advertising and direct mail but a matter of co-ordinating all three and using each on a basis of the job to be done.

McGRAW-HILL PUBLICATIONS

New York Chicago Cleveland Detroit Philadelphia St. Louis
Greenville San Francisco Boston London

P-12

Lagonda Mfg. Co., Springfield
Liberty Mfg. Co., Jeannette
Roto Co., Newark

Tube Cleaners, Condenser
Garlock Packing Co., Palmyra
Lagonda Mfg. Co., Springfield
Roto Co., Newark

Tube Cutters
Lagonda Mfg. Co., Springfield

Tubes Boiler
Babcock & Wilcox Tube Co., Beaver Falls
Pittsburgh (Pa.) Steel Products Co.
Standard Wire & Tube Co., Mineral Ridge
Tyler Tube & Pipe Co., Washington

Tubes, Boiler, Charcoal Iron
Standard Wire & Tube Co., Mineral Ridge
Tyler Tube & Pipe Co., Washington

Tubes Boiler Lapwelded
Standard Wire & Tube Co., Mineral Ridge
Tyler Tube & Pipe Co., Washington

Tubes, Condenser
Foster Wheeler Corp., New York
Scovill Mfg. Co., Waterbury

Tubing
Scovill Mfg. Co., Waterbury
Standard Wire & Tube Co., Mineral Ridge

Tubing, Chrome Alloy
Babcock & Wilcox Tube Co., Beaver Falls

Tubing, Seamless, Iron
Babcock & Wilcox Tube Co., Beaver Falls
Standard Wire & Tube Co., Mineral Ridge

Tubing, Seamless Steel
Babcock & Wilcox Tube Co., Beaver Falls
Standard Wire & Tube Co., Mineral Ridge

Turbines, Steam
Allis-Chalmers Mfg. Co., Milwaukee
Coppus Engineering Corp., Worcester
De Laval Steam Turbine Co., Trenton
Elliott Co., Jeannette
Moore Steam Turbine Corp., Wellsville
Sturtevant Co., B. F., Hyde Park
Terry Steam Turbine Co., Hartford

Turbines, Water
Allis-Chalmers Mfg. Co., Milwaukee

Turbo-Generators
Elliott Co., Jeannette
Terry Steam Turbine Co., Hartford

Unions & Union Fittings
Dart Mfg. Co., E. M., Providence
Jefferson Union Co., N. Y.

Vacuum Cleaners
Sturtevant Co., B. F., Hyde Park

Valve Control, Electric
Jenkins Bros., N. Y.
Pittsburgh Valve Foundry & Construction Co., Pittsburgh

Valve Disks
Garlock Packing Co., Palmyra

Valve Reseating Machine
Leavitt Mach. Co., Orange, Mass.

Valves, Automatic Air
Simplex Valve & Meter Co., Phila.
Sterling Engr. & Mfg. Corp., Boston
Templeton Mfg. Co., Boston

Valves, Automatic Cutoff
Elliott Co., Jeannette, Pa.
Yarnall-Waring Co., Phila.

Valves, Back Pressure
Cochrane Corp., Phila.
Davis Regulator Co., G. M., Chicago
Jenkins Bros., N. Y.

Valves, Balanced
Davis Regulator Co., G. M., Chicago
Nason Mfg. Co., N. Y.
Swartwout Co., Cleveland

Valves, Blowoff
Elliott Co., Jeannette, Pa.
Homestead Valve Mfg. Co., Coraopolis
Jenkins Bros., N. Y.
Lunkenheimer Co., Cincinnati
Yarnall-Waring Co., Phila.

Valves, Brass and Iron Body
Homestead Valve Mfg. Co., Coraopolis
Lunkenheimer Co., Cincinnati
Michigan Valve & Fdry. Co., Detroit
National Valve & Mfg. Co., Pittsburgh
Pittsburgh (Pa.) Piping & Equip. Co.
Reading Steel Casting Co., Bridgeport

Valves, Check
Cochrane Corp., Phila.
Davis Regulator Co., G. M., Chicago
Golden-Anderson Valve Specialty Co., Pittsburgh
Greene, Tweed & Co., N. Y.
Jenkins Bros., N. Y.
Lunkenheimer Co., Cincinnati
Pittsburgh (Pa.) Valve Foundry & Construction Co.
Schutte Koerting, Philadelphia

Valves, Coal Bin
Jeffrey Mfg. Co., Columbus

Valves, Exhaust Relief
Davis Regulator Co., G. M., Chicago
Jenkins Bros., N. Y.
Wheeler Mfg. Co., C. H., Phila.

Valves, Float
Cochrane Corp., Phila.
Davis Regulator Co., G. M., Chicago
Yarnall-Waring Co., Phila.

Valves, Gate
Greene, Tweed & Co., N. Y.
Jenkins Bros., N. Y.
Lunkenheimer Co., Cincinnati
Pittsburgh (Pa.) Piping & Equip. Co.
Pittsburgh (Pa.) Valve Foundry & Construction Co.
Wheeler Mfg. Co., C. H., Phila.

Valves, Globe
Jenkins Bros., N. Y.
Lunkenheimer Co., Cincinnati
Pittsburgh (Pa.) Valve Foundry & Construction Co.

Valves, Hydraulic
Homestead Valve Mfg. Co., Coraopolis
Swartwout Co., Cleveland
Vogt Machine Co., Henry, Louisville
Yarnall-Waring Co., Phila.

Valves, Motor Operated
Minneapolis (Minn.) Honeywell Regulator Co.
Pittsburgh (Pa.) Valve Foundry & Constr. Co.

Valves, Non-Return Stop
Elliott Co., Jeannette, Pa.
Jenkins Bros., N. Y.

Valves, Pump Rubber
Garlock Packing Co., Palmyra
Jenkins Bros., N. Y.

Valves, Reducing
Atlas Valve Co., Newark
Bailey Meter Co., Cleveland
Schutte Koerting, Philadelphia
Squires Co., C. E., Cleveland
Swartwout Co., Cleveland

Valves, Regulating
Atlas Valve Co., Newark
Bailey Meter Co., Cleveland
Bristol Co., Waterbury
Minneapolis Honeywell Regulator Co., Minneapolis
Pittsburgh Valve Foundry & Construction Co., Pittsburgh
Powers Regulator Co., Chicago
Simplex Valve & Meter Co., Phila.
Squires Co., C. E., Cleveland
Swartwout Co., Cleveland

Valves, Relief
Cochrane Corp., Phila.
Pittsburgh Valve Foundry & Construction Co., Pittsburgh
Swartwout Co., Cleveland

Valves, Safety
Ashton Valve Co., Cambridge
Jenkins Bros., N. Y.
Lunkenheimer Co., Cincinnati

Valves, Steel
Lunkenheimer Co., Cincinnati

Valves, Stop
Jenkins Bros., N. Y.

Valves, Stop Check
Elliott Co., Jeannette, Pa.

Valves, Superheated Steam
Jenkins Bros., N. Y.
Pittsburgh (Pa.) Valve Foundry & Construction Co.
Schutte Koerting, Phila.
Vogt Mach. Co., Henry, Louisville

Valves, Two, Three and Four-Way
Nicholson & Co., W. H. Wilkes-Barre

Valves, Throttle
Schutte Koerting, Philadelphia

Ventilators
Burt Mfg. Co., Akron
Sturtevant Co., B. F., Hyde Park

Vises
Curtis & Curtis Co., Bridgeport
Toledo Pipe Threading Mach. Co., Toledo

Walls, Water
Badenhausen Corp., Cornwells Heights
Blaw-Knox Co., Pittsburgh
Edge Moor (Del.) Iron Co.
Springfield (Ill.) Boiler Co.

Water Backs, High and Low Pressure
Foster Wheeler Corp., N. Y.
McClave-Brooks Co., Scranton
Yarnall-Waring Co., Phila.

Waterproofing
Carey Co., Philip, Cincinnati

Water Purifying Apparatus
Cochrane Corp., Phila.
Elgin Softener Corp., Elgin
Griscom-Russell Co., N. Y.
Hagan Corp., Pittsburgh
Scaife, Wm. B. Sons Co., Oakmont

Water Softening Apparatus
Cochrane Corp., Phila.
Elgin Softener Corp., Elgin
Griscom-Russell Co., N. Y.

Water Treatment, Feed
Dearborn Chemical Co., Chicago
Standard Engineering & Lubricating Co., N. Y.

Water Wheels
Allis-Chalmers Mfg. Co., Milwaukee

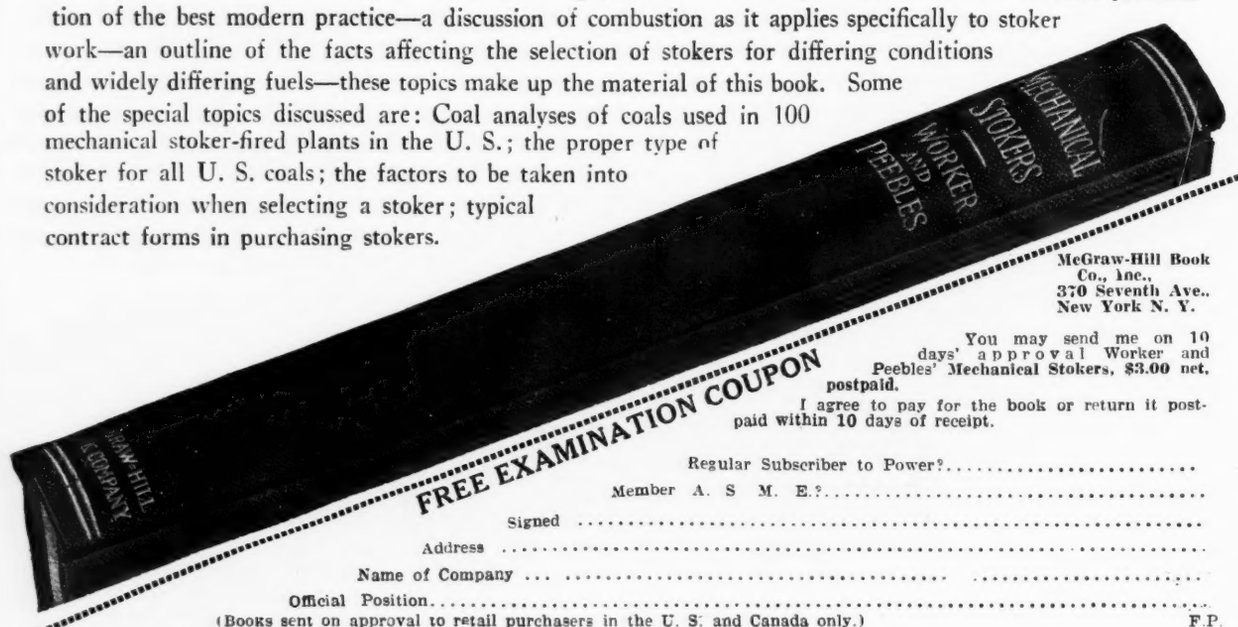
Wrenches
Greene, Tweed & Co., N. Y.

Facts

on the design, installation and operation of

Mechanical Stokers

This book—Worker and Peebles' MECHANICAL STOKERS ($3.00)—gives reliable unbiased opinions and facts from actual field experience in the design, installation and operation of stokers—a sound presentation of the best modern practice—a discussion of combustion as it applies specifically to stoker work—an outline of the facts affecting the selection of stokers for differing conditions and widely differing fuels—these topics make up the material of this book. Some of the special topics discussed are: Coal analyses of coals used in 100 mechanical stoker-fired plants in the U. S.; the proper type of stoker for all U. S. coals; the factors to be taken into consideration when selecting a stoker; typical contract forms in purchasing stokers.



FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.,
370 Seventh Ave.,
New York N. Y.

You may send me on 10 days' approval Worker and Peebles' Mechanical Stokers, $3.00 net, postpaid.

I agree to pay for the book or return it postpaid within 10 days of receipt.

Regular Subscriber to Power?.....

Member A. S. M. E.?.....

Signed .....

Address .....

Name of Company ... .

Official Position.....

(Books sent on approval to retail purchasers in the U. S. and Canada only.) F.P.

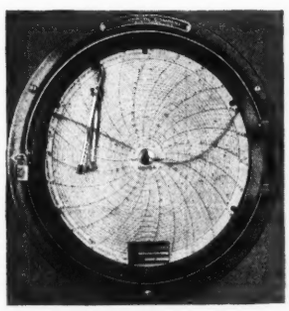
Vacuum!

By securing a better control over Vacuum conditions, Power Plant Engineers have an excellent chance to effect real power savings.

Take condensers for example. Low vacuum results in inefficient steam consumption and lowered operating efficiency of engines or turbines. On the other hand uniformly high vacuum assures best performance of prime movers, and enables extraction of more power from the same amount of steam.

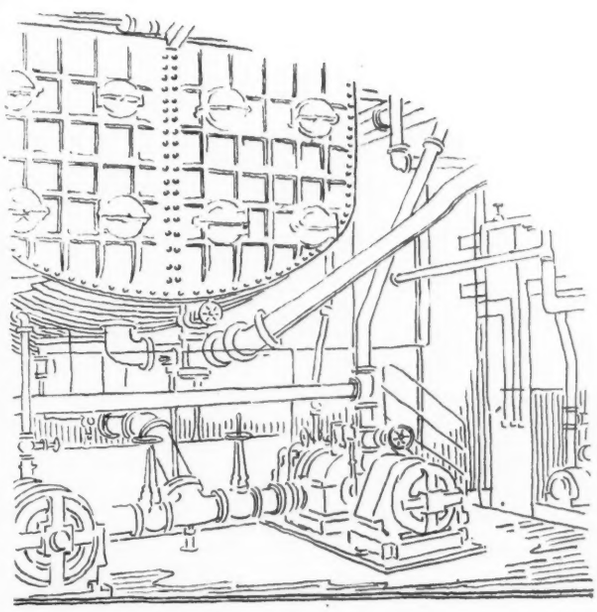
Bristol's Indicating Pressure-Vacuum Gauge, Flush Type Model, for panelboard Mounting.

To aid in bringing about such control, BRISTOL'S Recording or Indicating Pressure-Vacuum Gauges are frequently installed in the steam exhaust line before it enters the condenser. These Instruments provide a continuous check on the exact vacuum maintained, thus permitting operators to determine at any time just how efficiently the condenser is functioning.



Bristol's Recording Pressure-Vacuum Gauge, Flush Type Model, shown equipped with inverted penarm arrangement.

Also, where rotative dry vacuum pumps are employed, Bristol's Pressure-Vacuum Gauges are installed at each pump to show pump suction; thus giving a check on the efficiency of this important condenser auxiliary.



Write for more complete information, prices, etc. Bristol's Engineering Service is available without obligation.

THE BRISTOL CO., WATERBURY, CONN.

BRANCH OFFICES:
Boston
New York
Philadelphia
Pittsburgh
Birmingham
Chicago

BRISTOL'S
Recording Instruments

BRANCH OFFICES:
Detroit
Akron
Denver
St. Louis
Los Angeles
San Francisco

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